Section 4.13
Wildlife

This section discusses wildlife and wildlife habitats in the project study area, the regional study area, and the Great Salt Lake Ecosystem (GSLE), as defined below. It updates the affected environment, potential environmental consequences on wildlife, and proposed mitigation measures presented in the Final EIS. The discussion of environmental consequences considers development since publication of the Final EIS, including construction activities associated with Alternative D (Final EIS Preferred Alternative; see Section 4.20), unrelated development in the study area, and the revised right-of-way width and typical cross section associated with all the proposed build alternatives (see Chapter 3, *Alternatives*).

4.13.1 Approach and Methodology

As described in Section 2.5, *Wildlife Impacts Analysis*, in response to the tenth circuit court remand of the Final EIS for the Legacy Parkway project and comments received during public scoping, the federal lead agencies have expanded the scope of the wildlife analysis presented in the June 2000 Final EIS. The wildlife analysis presented herein expands the analyses of direct, indirect, and cumulative impacts on wildlife presented in the Final EIS, particularly analyses of impacts on migratory bird species, within 305 m (1,000 ft) of the project right-of-way and beyond to include various broad geographical zones pertinent to particular wildlife issues. To help develop the approach and methodology for addressing the wildlife issues raised by the court and other wildlife issues raised during scoping, the lead agencies and UDOT formed a science technical team (STT) consisting of resource agency scientists. The *Legacy Parkway Wildlife Impacts Analysis Technical Memorandum* (wildlife technical memorandum) (Jones & Stokes 2005) was prepared to document the process, methodology, and analysis for addressing wildlife impacts. This section of the Supplemental EIS is based on the results of that wildlife technical memorandum, as well as on review of the Final EIS and the administrative record.

To fully evaluate the potential impacts of the proposed Legacy Parkway on wildlife within and beyond 305 m (1,000 ft) of the project right-of-way, the effects were analyzed at two geographic levels within the GSLE, each of which extends beyond 305 m (1,000 ft) of the right-of-way: the project level (project study area) and the regional level (regional study area). These areas are described below and shown in Figures 4.13-1, 4.13-2 and 4.13-3. Additional analysis of wetland and wildlife impacts and mitigation on the Legacy Nature Preserve is provided in Appendix E, *Analysis of the Adequacy of Wetlands and Wildlife Mitigation Technical Report*.

As described in the following sections, impacts were identified and assessed in this Supplemental EIS on both a habitat and a species-specific basis. Habitat-based impact analysis is a standard, scientifically valid, and widely accepted method for evaluating project effects on wildlife. This methodology was fully reviewed and approved by the Legacy Parkway STT, and was based on the best available biological information on bird species in the project study area. Local surveys of bird populations in both the regional and project study areas (Dolling 2003, Paul and Manning 2002) and scientific literature were

used to estimate species densities and to verify the effects of habitat loss and change. (See the wildlife technical memorandum for a detailed assessment of bird population densities and abundances in the project and regional study areas.) It was determined that habitat availability and quality are key determinants of long-term viability of species within the project and regional study areas. Therefore, the analysis of impacts on wildlife in the Supplemental EIS was designed to provide specific quantitative or qualitative information on the effects of the proposed action on wildlife species and their habitats, and in particular migratory birds.

4.13.1.1 Project Study Area

The study area for the project-level analysis encompassed the Final EIS wildlife study area, the proposed Legacy Nature Preserve mitigation area, and additional lands included in the wetland delineation study (Baseline Data, Inc. et al. 1998) (Figures 4.13-1 and 4.13-2). The project study area encompasses 4,186 ha (10,344 ac), which is also the total area for which high-resolution geographic information system (GIS) data was available for mapping wildlife habitats. This enabled the project-level analysis to be conducted using this high-resolution dataset. The footprints of all the proposed build alternatives are entirely within the project study area.

4.13.1.2 Regional Study Area

The regional study area was used to evaluate all project-related effects on wildlife beyond the project study area. Many migratory birds that use the project study area move seasonally along the Wasatch Front, stopping at other wetland areas from Utah Lake to the Bear River National Wildlife Refuge. Utah Lake was included in the regional study area because approximately 156 migratory bird species found around Utah Lake also use habitats around Great Salt Lake (Utah Department of Natural Resources and Energy, Division of Wildlife Resources 1982; Jones & Stokes 2005), and many of their populations are likely connected by regular movement between the two areas. It is recognized, however, that Utah Lake is a freshwater ecosystem, while Great Salt Lake is primarily saline. Bird species that rely heavily on brine shrimp and brine flies in their diet (e.g., Eared Grebe; Wilson's Phalarope; and various duck, gull, and shorebird species) naturally concentrate on Great Salt Lake, where these foods are exclusively located. Other migratory birds, including other waterbirds, raptors, and migratory songbirds not dependent on these foods, are likely to find needed resources in suitable habitats common to either Utah Lake or Great Salt Lake.

To capture the areas that all of these species are likely to use, the study area for the regional-level wildlife analysis was defined by three parameters: (1) a subset of USGS hydrologic units in the eastern portion of the GSLE, (2) the extent of these units for which comprehensive regional GIS land-use data were available, and (3) the portion of these areas below 1,433 m (4,700 ft) in elevation (Figures 4.13-1 and 4.13-3). The 1,433-m (4,700-ft) elevational boundary was selected to include wetland habitats associated with Utah Lake that could potentially be used by migrating birds that also use the project study area, as described above.

4.13.1.3 Great Salt Lake Ecosystem

The proposed Legacy Parkway project is located on the southeast shore of Great Salt Lake. In this report, the GSLE refers to Great Salt Lake, its floodplains, and all adjacent wildlife habitats that are used by migratory bird species (Figure 4.13-4), as mapped in Aldrich and Paul (2002).

4.13.1.4 Methods Used to Acquire Information

The analysis and methodology presented in the wildlife technical memorandum was used to update the affected environment and environmental consequences information presented in Sections 3.13 and 4.13 of the Final EIS. The wildlife technical memorandum and supplemental wildlife analysis presented in this document were prepared with input from the science technical team, which comprised ecologists and biologists from FHWA, the Corps, UDOT, and their representative technical consultants, as well as wildlife biologists and technical experts from the U.S. Fish and Wildlife Service (USFWS), U.S. Environmental Protection Agency (EPA), and Utah Department of Natural Resources (UDNR). This inclusive approach was intended to ensure that the best available scientific information was acquired and appropriately analyzed in the Supplemental EIS. The following methods were used to acquire information on migratory birds, upland and wetland habitats, and special-status species in the GSLE.

- **Habitat Delineation.** The following wildlife habitats within the project study area were delineated and mapped: open water, riparian, sedge cattail, hydric meadow, mudflat/pickleweed, pasture, cropland, salt desert scrub, and developed (urban landscaping). For an explanation of the correspondence of wildlife habitats and wetland cover types, see Table 4.12-3.

- **GIS Mapping.** Wildlife habitats within the GSLE for which GIS data were available were mapped.

- **Species Identification**. Wildlife species that use or could potentially use the delineated habitats were identified, and their ecological status (seasonal occurrence, breeding and migratory status, habitat requirements, etc.) within the project study area and the GSLE was documented using available data. A thorough review of scientific literature identified and provided information about wildlife species in the project study area, regional study area, and GSLE.

- **Habitat Evaluation**. The ecological importance of the different habitats to migratory wildlife within the project study area and the GSLE was evaluated.

- **Literature Review**. Scientific literature on the potential impacts of highway noise, artificial light, highway mortality, habitat modification, and human disturbance on wildlife was reviewed.

4.13.1.5 Methods Used in the Analysis

Information collected from the above data sources and data-collecting methods was used to evaluate the potential impacts of the proposed action on wildlife resources within the project study area, regional study area, and GSLE. On the basis of this information, a list of species that occur or that could potentially occur in the project study area was prepared. Because of the importance of the project and regional study areas and the GSLE to migratory birds, these taxa were the focus of the evaluation of impacts on wildlife. The wildlife impact analysis emphasized habitat types; most wildlife species utilize multiple habitat types, and such habitat-based analysis is a widely accepted basis for assessing potential impacts.

Several analyses were conducted to complete this evaluation; these analyses are briefly summarized below to provide context for the impact assessment presented in Section 4.13.3. A complete discussion of the methods used to complete these analyses is presented in the wildlife technical memorandum.

GIS Analysis of Habitat Change

A GIS analysis was conducted to determine how wildlife habitat would change within the project study area with implementation of the Legacy Parkway project, and how these changes could potentially affect species that use the habitats locally and regionally around Great Salt Lake. Measures of habitat change included habitat loss, habitat fragmentation (see Section 4.13.2.5, *Existing Conditions Related to Wildlife Habitats in Project Study Area*, for a definition of this term), and habitat degradation. The following text describes the methods used to assess these parameters.

The GIS analysis was based on 4-foot contours interpolated from a USGS 10-meter digital elevation model. Additional elevation data was obtained in 2004 from aerial photographs of the Legacy Nature Preserve to facilitate development of the proposed mitigation plan. Section 3.0 of Appendix E, *Analysis of the Adequacy of the Wetlands and Wildlife Mitigation Technical Report*, of this Supplemental EIS provides a detailed discussion of how these different data sets were used for the wildlife analysis.

Habitat Loss

Direct habitat loss that would occur as a result of highway construction was determined by overlaying the right-of-way boundary for each build alternative onto the wildlife habitat map and using GIS software to measure the total area of each habitat within those boundaries.

Habitat Fragmentation

Several different habitat fragmentation metrics, including mean patch size, mean perimeter-to-area ratio, and mean nearest neighbor distance, were used to evaluate the fragmentation effects of changes in size and distribution of suitable habitats resulting from the build alternatives. FRAGSTATS, a fragmentation analysis software, and Patch Analyst, an ArcView3.2 extension, in combination with GIS analysis, were used to determine the existing number of habitat patches in the project study area, the number of habitat patches (by patch size) that would be fragmented by a build alternative, and the number of habitat patches (by patch size) that would result after fragmentation associated with a build alternative. The habitat fragmentation analysis also considered trends in fragmentation (i.e., trends in the number of patches in each size group and of the total extent of each habitat type by patch size) and mean and median patch size.

Habitat Degradation

A qualitative assessment of potential changes in air quality and water quality resulting from construction and operation of the proposed build alternatives was completed to determine potential habitat degradation effects on wildlife species in the project study area. This assessment included a qualitative evaluation of potential wildlife mortality resulting from exposure to a new roadway system, as well as how changes to the wetland hydrology and addition of artificial lighting and landscaping could further affect existing wildlife habitat. These assessments were supported through review of recent and relevant literature and input from the wildlife technical team, as described in the wildlife technical memorandum.

GIS Analysis of Changes in Lake Level and Dynamics of Habitat Availability and Distribution

A GIS analysis was conducted to evaluate the interaction of changes in the level of Great Salt Lake with the direct habitat availability and losses that would result from each build alternative. The wildlife habitat maps were combined with an inundation zone dataset for Great Salt Lake (U.S. Geologic Survey 2003) to illustrate the potential combined habitat loss from natural lake level fluctuation and the proposed

alternatives. Details of these calculations are provided in Appendix B of the wildlife technical memorandum.

Highway Noise Disturbance

To assess the potential impacts of highway noise on wildlife in the project vicinity, including the potential indirect impacts on bird species both within and beyond 305 m (1,000 ft), two approaches were used. First, to estimate the distance at which project highway noise could potentially affect wildlife communication, an analysis was conducted of the bioacoustics requirements of representative birds and the masking potential of highway noise on those species' communications. Species analyzed were selected to represent the range of sound frequencies present in the bird songs and calls.

Second, to assess the area of each habitat type within and adjacent to the project study area that could potentially be affected by highway noise, noise contours were modeled for each project alternative and delineated on a map of the habitats in the project study area. From this map, the approximate area of noise effect for each build alternative could be calculated.

A detailed description of the methods used to complete the bioacoustics analysis and the highway noise model analysis are presented in Appendix F of the wildlife technical memorandum.

4.13.1.6 Changes since Draft Supplemental EIS

Changes have been made to the wildlife section since the Draft Supplemental EIS was published in December 2004. Those changes were made for the following reasons.

- The acreage of habitat loss for the American avocet was found to be based on incorrect calculations, which have been subsequently revised. See Section 4.13.3.12, *Potential Effects on Species of Concern*.

- As stated in Section 4.0, *Introduction*, additional minor modifications have been made to the alignments of Alternatives A and E (Final EIS Preferred Alternative) since preparation of the Draft Supplemental EIS. In addition the 1997 developed lands dataset and the wildlife habitat map have been updated (Keller pers. comm. 2005). These modifications and updates have resulted in changes to the following information.

  - Acreage of direct habitat loss associated with each of the build alternatives (see 4.13.1, *Direct Habitat Loss*).

  - Acreage of potential impacts of future development and the build alternatives (see Table 4.13-5).

  - Comparative acreage of habitat within the regional study area, project study area, and build alternative alignments (see Table 4.13-6).

  - Percentage of regionally available wildlife habitat lost under each build alternative (see Table 4.13-7).

  - Acreage of habitat that would be fragmented under each build alternatives (see Table 4.13-10).

- Acreage of habitat loss (e.g., direct habitat loss, loss of foraging habitat, loss of habitat as a percent of the regional habitat available) for species of concern in the project study area (see 4.13.3.12, *Potential Effects on Species of Concern*).

- Number of pairs of American avocet, Wilson's phalarope, burrowing owl, and short-eared owl affected by the proposed build alternatives, as well as the number of loggerhead shrike territories and the number of Brewer's sparrows affected (see 4.13.3.12, *Potential Effects on Species of Concern*).

- Modifications to the watershed boundaries associated with the regional study area (see Section 4.13.1.2, *Regional Study Area*) resulted in changes to the assessment of regional wildlife habitat available at low and high levels of Great Salt Lake (Table 4.13-8), and to the assessment of availability of wildlife habitat within the project study area at low and high lake levels (Table 4.13-9).

- Nomenclature of wildlife habitats was revised to avoid confusion with wetland cover types. Table 4.12-3 describes the name changes.

- Grasshopper sparrow was removed from the analysis presented in Section 4.13.3.12, *Potential Effects on Species of Concern*, because it was determined that it was unlikely to occur in the project study area (see Section 3.0, *Effects on Special-Status Wildlife*, of the wildlife technical memorandum).

4.13.2 Affected Environment

This section presents a summary of updated information on the affected environment relative to wildlife and the occurrence of special-status species in the GSLE and in the project study area. The description of existing conditions accounts for recent land development since publication of the Final EIS, including initial construction activities associated with Alternative D (Final EIS Preferred Alternative; see Section 4.20, *Construction Impacts*) and unrelated development in the study area, and the revision in the width of the right-of-way and typical cross section associated with all the proposed build alternatives (see Chapter 3, *Alternatives*). A description of historic conditions is included to provide context for the discussion of cumulative impacts in the environmental consequences section.

4.13.2.1 Changes in Habitat since Final EIS

Project activities that have resulted in changes in habitat in the project study area since the Final EIS was published are described in detail in Section 4.20, *Construction Impacts*. In summary, UDOT began construction on Legacy Parkway in summer 2001. The project under construction was Alternative D (Final EIS Preferred Alternative). UDOT implemented a design-build delivery system to construct the project until construction was halted in November 2001 because of an injunction from the U.S. Court of Appeals for the Tenth Circuit.

The following habitat modifications have occurred to date.

- Approximately 4.9 ha (12 ac) of vegetation (hydric meadow, sedge cattail, and mudflat/pickleweed habitat patches scattered in upland pasture) at the I-215 interchange location at the southern terminus of the proposed action were cleared and grubbed (all vegetation removed). Fill of varying heights (up to 6 m [20 ft]) was also placed in this area. These areas are treated as having essentially no wildlife habitat value.

- Vegetation (largely cropland and pasture with intermittent patches of hydric meadow, sedge cattail, and mudflat/pickleweed) was cleared from a segment about 6 km (3.7 mi) long by 98 m (320 ft) wide at the southern terminus of the project near I-215. This area was graded and fill (about 0.6 m to 0.9 m [2 ft to 3 ft] in height) was added. A segment about 1 km (0.7 mi) long by 98 m (320 ft) wide just north of 500 South was also cleared of pasture/cropland vegetation. These areas are treated as having essentially no wildlife habitat value.

- The entire interchange at I-15 at the northern terminus of the project has been cleared of all vegetation (hydric meadow and pasture habitat with a mixture of sedge cattail, open water, and cropland habitat patches). These areas are treated as having essentially no wildlife habitat value.. Construction activities, with associated habitat disturbance and modification, continue on the extension of Park Lane (formerly Burke Lane) and all ramps from Park Lane to I-15 and US-89 and the Shepard Lane project. Construction of drainage facilities also continues in this area. The Park (formerly Burke) Lane and drainage facility construction has been completed. Some bridge construction (piers and abutments) was initiated for the Legacy Parkway mainline over I-15, but it was not completed before the court injunction halted construction.

4.13.2.2 Historic Habitat Conditions

There has been a 58 percent reduction in wetland/wildlife habitats[1] from estimated historic conditions (pre-settlement; before 1847) to current conditions in the regional study area. The amount of loss varies by hydrologic unit. The Ogden hydrologic unit, which has the second highest historic wetland/wildlife extent in the regional study area and where the majority of the proposed action would be located, has already lost nearly 70 percent of its estimated historic wetland/wildlife habitats. The comparison of estimated historic conditions to current conditions illustrates the downward trend in the extent of wetland/wildlife habitats in the regional study area. The extent of remaining estimated historic wetland/wildlife habitats is provided below and detailed in the wildlife technical memorandum.

- **Regional study area**. Forty-two percent of the estimated historic wetland/wildlife habitats is still available in the regional study area.

- **Hydrologic unit**. The extent of remaining habitat varies by hydrologic unit. Some examples are listed below.

  - Tooele Valley hydrologic unit: 80 percent (22,652.7 ha [56,370 ac]) of historic habitat remains.

  - Utah Lake hydrologic unit: 17 percent (3,870 ha [11,018 ac]) of historic habitat remains.

[1] The term *wetland/wildlife habitat* refers to a mapping category comprising polygons that include soils suitable for wetland vegetation, as well as associated upland areas, as defined by the Natural Resource Conservation Service Soil Survey Geographic (SSURGO) database and the USFWS National Wetlands Inventory (NWI) dataset. These datasets were used to establish a baseline of historic wetland and associated upland habitat distribution for use in evaluating temporal changes in habitat distribution and availability. Accordingly, this term pertains only to quantitative analysis involving historic conditions. These datasets are explained in greater detail in Section 3.11.1, *Historic Conditions: Cumulative Habitat Loss/Degradation from Past Activities*, of the wildlife technical memorandum.

- Ogden hydrologic unit: 30 percent (14,898 ha [35,043 ac]) of historic habitat remains.
- Jordan River hydrologic unit: 38 percent (12,477 ha [37,333 ac]) of historic habitat remains.

4.13.2.3 Existing Wildlife in Project Study Area

Great Salt Lake and the wetlands surrounding its shoreline provide important habitat for a great variety of amphibians, reptiles, birds, and mammals, some of which are rare and have small geographical distributions. In total, 12 fish species, 8 amphibians, 10 reptiles, 219 birds, and 50 mammals have been documented as occurring within the project study area or are believed to have the potential to occur there based on the presence of suitable habitat and the general abundance of the species in the GSLE. Of these species, 223 (215 birds, 8 bats) are migratory. A total of 136 species are known to occur in the project right-of-way areas, and an additional 139 species could potentially occur there. Up to 120 of these species could potentially breed within the project study area. Tables 4.13-1a and b describe the abundance of these species in the GSLE and the project study area, as well as the migratory, breeding, foraging, and other habitat use patterns of these species in these areas. In addition, Section 2.4, *Ecological Setting*, of the wildlife technical memorandum provides a detailed description of how different species use the existing wildlife habitat in the project study area (see 4.13.2.4, *Existing Wildlife Habitats in the Study Area*) for migration, breeding, foraging, escape cover, and other habitat uses.

Twenty-eight species, including 24 migratory birds, two bats, one shrew, and one fox are classified as special-status species, or species that are protected by one or more state or federal environmental laws (Table 4.13-2). For the purposes of this section, *special-status species* include species identified on the following lists and/or covered by the following regulations.[2]

- Federal.
  - Federally listed endangered and threatened species.
  - Federal candidate species.
  - Migratory Bird Treaty Act species (16 USC 703–711).
  - Fish and Wildlife Conservation Act species (16 USC 2901–2911).
- State of Utah.
  - Utah State Species of Concern (Utah Administration Rule R657-48).
  - State of Utah Conservation Agreement Species.

Table 4.13-2 summarizes the legal and protected status, habitat use, and seasonal occurrence of each special-status species. The table also describes the abundance of each species within the GSLE and the project study area, as well as their migratory, breeding, foraging, and other habitat use patterns in these areas. As noted above, Section 2.4 of the wildlife technical memorandum also provides a detailed description of how specials-status species use existing wildlife habitat in the study area.

[2] Of note, Section 4.15, *Threatened and Endangered Species*, provides a specific discussion of impacts on species protected under the federal Endangered Species Act and as species of special concern by the Utah Division of Wildlife Resources that could occur in the study area, defined in Section 4.0.1, *Study Area*.

	Migratory Species	GSL Ecosystem					Legacy Parkway Project Study Area							Farmington Bay WMA					Bear River NWR					Habitat Use									
		Seasonal Abundance				Breeds in GSLE	Seasonal Abundance				Breeds in Project Study Area	Documented Occurrence within Project Study Area	Could Potentially Occur within Project Study Area	Seasonal Abundance				Breeds in FBWMA	Seasonal Abundance				Breeds in BRNWR	Open Water	Riparian	Sedge Cattail	Hydric Meadow	Mudflat/Pickleweed	Pasture	Cropland	Salt Desert Scrub	Developed
		P	S	W	T		P	S	W	T				P	S	W	T		P	S	W	T									
Loons																																
Pacific Loon	X				RT								X									RT		F								
Common Loon	X				RT								X									UT		F								
Grebes																																
Pied-billed Grebe	X		CS	UW		X		US	RW		X	X			CS	UW		X		CS	UW		X	F		FB	F					
Horned Grebe	X			RW	RT								X			RW	RT				RW	RT		F		F						
Eared Grebe	X		CS	RW		X		RS		CT		X			CS	RW		X		US		CT	X	FB		B						
Western Grebe	X		CS	RW		X				RT		X			CS			X		CS	RW		X	FB		B						
Clark's Grebe	X		CS			X							X		CS			X		CS	RW		X	FB		B						
Pelicans and Cormorants																																
American White Pelican (SPC)	X		CS			X		RS				X			CS					CS				F		F						
Double-crested Cormorant	X		CS			X		RS			X	X			CS			X		CS				F	B	F						
Wading Birds																																
American Bittern	X		RS			X							X		RS			X		RS						FB						
Great Blue Heron	X	CP				X	CP				X	X		CP				X	CP					F	FB	FB	F					
Great Egret	X		RS		RT								X				RT			RS				F		F						
Snowy Egret	X		CS			X		US				X			CS			X		CS			X	F	B	FB	F	F	F				
Cattle Egret	X		CS			X				RT		X			US					CS						B	F		F	F			
Black-crowned Night-heron	X		CS	RW		X		CS			X	X			CS	UW		X		CS			X	F	B	FB	F	F	F				
White-faced Ibis	X		CS			X		CS				X			CS			X		CS			X	F		FB	F	F	F	F			
Swans, Geese, Ducks																																
Tundra Swan	X			RW	CT`								X			RW	CT				RW	CT		F								
Trumpeter Swan	X			RW									X				O				RW			F								
Greater White-fronted Goose	X				RT								X				RT					A		F					F			
Snow Goose	X				UT								X				UT					UT				F				F			
Ross' Goose	X				RT								X				RT					RT				F				F			
Canada Goose	X	CP				X	CP				X	X		CP				X	CP				X	F		F	F	F	FB	F	F	F	
Wood Duck	X	RP											X	RP							RW			F								F	
Green-winged Teal	X		US	CW	CT	X				UT		X			US	CW	CT			US	CW	CT	X	F		FB	FB	F	F	F			
Mallard	X	CP				X	UP				X	X		CP				X	CP				X	F	F	FB	FB	F	FB	FB		F	
Northern Pintail	X		RS	RW	CT	X				UT		X			RS	UW	CT	X		RS	UW	CT	X	F		FB	FB	F	F	F	B		
Blue-winged Teal	X		US			X		RS				X			US		UT	X		US			X	F		FB	FB	F	F				
Cinnamon Teal	X		CS	RW		X		RS				X			CS	RW		X		CS	RW		X	F		FB	FB	F	F	F			
Northern Shoveler	X		RS	UW	CT	X				UT		X			RS	UW	CT	X		RS	UW	CT	X	F		FB	FB	F	F		B		
Gadwall	X		CS	UW		X		US	UT		X	X			CS	UW		X		CS	UW		X	F		FB	FB	FB	FB	FB	B		
Eurasian Wigeon	X				RT					RT		X										RT		F		F	F	F	F	F			
American Wigeon	X			UW	CT					RT		X				UW	CT				UW	CT		F		F	F	F	F	F			
Canvasback	X		RS	RW	CT	X							X		RS	RW	CT	X		RS	RW	UT	X	F		FB							
Redhead	X		CS	RW		X							X		CS	UW		X		CS	RW		X	F		FB							
Ring-necked Duck	X			RW	RT								X			RW					RW	RT		F									
Greater Scaup	X				UT								X				RT					RT		F									
Lesser Scaup	X			CW									X			UW	CT				UW	CT		F									
Long-tailed Duck	X			RW									X				O				RW			F									
White-winged Scoter	X			RW									X				O				RW			F									
Surf Scoter	X			RW									X				O				RW			F									
Common Goldeneye	X			CW					RW			X				UW	CT				UW	CT		F									
Barrow's Goldeneye	X			RW									X			RW					RW			F									
Bufflehead	X			CW									X			UW	CT				UW	CT		F									
Hooded Merganser	X			RW	RT								X			RW	RT				RW	RT		F									
Common Merganser	X			UW	CT								X			UW	CT				RW	CT		F									
Red-breasted Merganser	X			UW	CT								X			RW	CT				RW	CT		F									
Ruddy Duck	X		CS	UW		X				RT		X			CS	UW		X		CS	UW		X	F		FB							
Diurnal Raptors																																
Turkey Vulture	X		CS					US				X			US					CS								F	F	F	F	F	
Osprey	X				RT					RT		X					RT					RT		F									
Bald Eagle (FT)	X		RS	CW		X		RS	CW		X	X				CW					CW				FB	F	F	F	F		F	
Northern Harrier	X	CP				X	CP				X	X		CP				X	CP				X		F	FB	F	F	FB	F	FB	F	
Sharp-shinned Hawk	X			UW	UT					RT		X					RT				UW	UT			F			F	F	F	F	F	
Cooper's Hawk	X			UW	UT					RT		X					RT				UW	UT			F			F	F	F	F	F	
Northern Goshawk (CAS)	X				RT							(X)									RW	RT			F						F		
Swainson's Hawk (BCC)	X		RS		UT	X		RS			X	X					UT			CS					B		F	F	F	F	F		
Red-tailed Hawk	X	CP				X	UP				X	X		CP				X	CP				X		B		F	F	F	F	F	F	
Ferruginous Hawk (BCC; SPC)	X		RS										X				RT			US							F	F	F	F	F		
Rough-legged Hawk	X			CW					CW			X				CW					CW						F	F	F	F	F	F	
Golden Eagle (BCC)	X	RP								RT		X		RP					UP								F	F	F	F	F		
American Kestrel	X	CP				X	CP				X	X		CP				X	CP						B		F	F	F	F	F	F	

	Migratory Species	GSL Ecosystem					Legacy Parkway Project Study Area							Farmington Bay WMA					Bear River NWR					Habitat Use								
		Seasonal Abundance				Breeds in GSLE	Seasonal Abundance				Breeds in Project Study Area	Documented Occurrence within Project Study Area	Could Potentially Occur within Project Study Area	Seasonal Abundance				Breeds in FBWMA	Seasonal Abundance				Breeds in BRNWR	Open Water	Riparian	Sedge Cattail	Hydric Meadow	Mudflat/Pickleweed	Pasture	Cropland	Salt Desert Scrub	Developed
		P	S	W	T		P	S	W	T				P	S	W	T		P	S	W	T									
Merlin	X			RW					RW			X				RW					UW						F	F	F	F	F
Peregrine Falcon (BCC)	X	RP				X	RP				X	X		UP				X	UP					F		F	F	F	F	F	F	F
Prairie Falcon (BCC)	X	RP				X	RP					X		UP					UP								F	F	F	F	F	
Pheasant and Quail																																
Ring-necked Pheasant		UP				X	RP				X	X		CP				X	UP						F		F	F	FB	FB	FB	FB
California Quail		RP											X	UP											FB				F		FB
Gruiformes																																
Virginia Rail	X		CS	RW		X		RS			X	X			CS	UW		X		CS			X			FB	F	F	F			
Sora	X		CS			X		RS			X	X			CS			X		CS			X			FB	F	F	F			
Common Moorhen	X	RP				X							X		RS			X	RP				X	F		FB						
American Coot	X	CP				X	UP				X	X		CP				X	CP				X	F		FB	FB	F	F	F		
Sandhill Crane	X		RS		UT	X				RT		X			RS			X		US		CT		F		FB	F	F	F	F		
Shorebirds																																
Black-bellied Plover	X				CT					RT		X					UT					UT					F	F	F			
American Golden-plover (BCC)	X				RT								X				RT					RT					F	F	F			
Snowy Plover (BCC)	X		CS			X							X		US			X		CS			X					FB				
Semipalmated Plover	X				UT								X				UT					RT						F				
Killdeer	X	CP				X	CP				X	X		CP				X		CS	RW		X				FB	FB	FB	FB	FB	FB
Black-necked Stilt	X		CS			X		CS			X	X			CS			X		CS			X	F		FB	FB	FB	FB			
American Avocet (BCC)	X		CS			X		CS			X	X			CS			X		CS			X	F		FB	FB	FB	FB			
Greater Yellowlegs	X				CT					UT		X					CT					CT		F			F	F	F			
Lesser Yellowlegs	X				CT					UT		X					CT					CT		F			F	F	F			
Solitary Sandpiper (BCC)	X				RT					RT		X					RT					UT			F		F	F	F			
Willet	X		CS			X		RS			X	X			CS			X		CS			X				FB	FB	FB	FB	FB	
Spotted Sandpiper	X		US			X				RT		X			CS			X				UT			FB			F				
Whimbrel (BCC)	X				RT								X				RT					RT						F	F			
Long-billed Curlew (BCC)	X		US		CT	X				RT		X			US			X		CS			X				F	FB			FB	
Marbled Godwit (BCC)	X				CT					RT		X					CT					CT		F			F	F	F			
Ruddy Turnstone	X				RT								X				RT					RT						F				
Red Knot	X				UT								X				RT					RT						F	F			
Sanderling (BCC)	X			RW	UT								X				UT				UW	RT						F				
Semipalmated Sandpiper	X				RT								X				UT					RT						F				
Western Sandpiper	X				CT					RT		X					CT					CT						F				
Least Sandpiper	X			RW	CT					RT		X				RW	CT				RW	CT						F				
Baird's Sandpiper	X				CT					RT		X					UT					UT						F				
Pectoral Sandpiper	X				UT					RT		X					UT					RT					F	F	F			
Dunlin	X				RT								X				RT					RT						F				
Stilt Sandpiper	X				RT								X				RT					RT						F				
Short-billed Dowitcher	X				RT								X				RT					RT		F		F	F	F				
Long-billed Dowitcher	X				CT					RT		X					CT					CT		F		F	F	F				
Wilson's Snipe	X	CP				X	CP				X	X			CS	UW		X		CS	UW		X			F	FB	F	FB			
Wilson's Phalarope (BCC)	X		US		CT	X		RS		UT	X	X			CS			X		US		CT		F		F	FB	F	F			
Red-necked Phalarope	X				CT					RT		X					CT					CT		F								
Gulls and Terns																																
Franklin's Gull	X		CS			X				CT		X			CS			X		CS				F		FB	F	F	F	F		
Bonaparte's Gull	X				UT					RT		X					UT					UT		F		F						
Ring-billed Gull	X		RS	CW		X			UW			X				CW				US	CW		X	F		F	F	F	F	F		F
California Gull	X	CP				X	UP					X		CP				X	CP				X	F		F	F	F	F	F	F	F
Herring Gull	X			UW									X			UW					UW			F								F
Thayer's Gull	X			RW									X			RW					RW			F								F
Glaucous Gull	X			RW									X			RW					RW			F								F
Caspian Tern	X		US			X		RS					X		US									F								
Common Tern	X				RT								X				RT					RT		F								
Forster's Tern	X		CS			X		CS			X	X			CS			X		CS			X	F		FB						
Black Tern	X		US			X		RS				X			US					US		CT		F								
Pigeons and Doves																																
Rock Pigeon	X	CP				X	UP				X	X							CP				X									FB
Mourning Dove	X		US	RW		X		US	RW		X	X			CS			X		CS			X		FB			F	F	F	F	FB
Cuckoos																																
Yellow-billed Cuckoo (FC)	X				RT								X												FB								FB
Owls																																
Barn Owl	X	UP				X	RP				X	X		RP					UP								F	F	F	F	F	FB
Great Horned Owl	X	UP				X	UP				X	X		CP					UP						FB	F	F	F	F	F	F	FB
Burrowing Owl (BCC; SPC)	X		RS			X		RS			X	X								US			X					F	F		FB	
Long-eared Owl	X				RW								X												F		F	F	F		F	
Short-eared Owl (SPC)	X	CP				X	UP				X	X		UP				X	UP				X			F	F	F	F	F	FB	

	Migratory Species	GSL Ecosystem					Legacy Parkway Project Study Area							Farmington Bay WMA					Bear River NWR					Habitat Use								
		Seasonal Abundance				Breeds in GSLE	Seasonal Abundance				Breeds in Project Study Area	Documented Occurrence within Project Study Area	Could Potentially Occur within Project Study Area	Seasonal Abundance				Breeds in FBWMA	Seasonal Abundance				Breeds in BRNWR	Open Water	Riparian	Sedge Cattail	Hydric Meadow	Mudflat/Pickleweed	Pasture	Cropland	Salt Desert Scrub	Developed
		P	S	W	T		P	S	W	T				P	S	W	T		P	S	W	T									
Goatsuckers and Swifts																															
Common Nighthawk	X				UT					UT		X					CT			CS				F	F	F	F	F	F	F	F	F
Common Poorwill	X			US						RT			X							US				F	F	F	F		F	F	F	F
White-throated Swift	X			US						RT			X				RT			US					F	F	F		F	F	F	F
Hummingbirds																															
Black-chinned Hummingbird	X		RS		RT					RT		X					UT			US					F		F	F	F	F	F	F
Calliope Hummingbird	X				RT								X				RT								F		F	F	F	F	F	F
Broad-tailed Hummingbird	X		RS		RT					RT		X					RT			US					F		F	F	F	F	F	F
Rufous Hummingbird	X				RT					RT		X					RT					UT			F		F	F	F	F	F	F
Kingfishers																															
Belted Kingfisher	X	UP				X	UP				X	X		UP					UP					F	FB							
Woodpeckers																															
Red-naped Sapsucker	X				RT								X				RT								F							F
Downy Woodpecker	X	RP				X							X	RP					UP						F							F
Northern Flicker	X	RP				X				RT		X		UP				X	UP						FB						F	FB
Flycatchers																															
Olive-sided Flycatcher	X				RT					RT		X													F						F	F
Western Wood-peewee	X				RT					RT		X										RT			F						F	F
Cordilleran Flycatcher	X				RT					RT		(X)										RT			F						F	F
Willow Flycatcher	X				RT					RT		(X)										RT			F						F	F
Hammond’s Flycatcher	X				RT					RT		(X)										RT			F						F	F
Dusky Flycatcher	X				RT					RT		(X)										RT			F						F	F
Gray Flycatcher	X				RT					RT		(X)										RT			F						F	F
Say’s Phoebe	X	RP				X							X				O		UP												FB	
Ash-throated Flycatcher	X				RT					RT		(X)										RT			F						F	F
Western Kingbird	X		CS			X		US			X	X			RS			X		US			X		FB		F	F	F	F	F	FB
Eastern Kingbird	X				RT								X				O								F							F
Shrikes																															
Northern Shrike	X			UW					UW			X				RW					UW				F	F	F	F	F	F	F	F
Loggerhead Shrike (BCC)	X	UP				X	UP					X		RP					RP						F	F	F	F	F	F	FB	F
Vireos																															
Plumbeous Vireo	X				RT								X				RT					RT			F							F
Warbling Vireo	X				RT					RT		X					RT					RT			F						F	F
Jays, Crows, and Allies																															
Black-billed Magpie	X	UP				X	UP				X	X		UP				X	CP				X		FB		F	F	F	F	F	FB
American Crow	X			RW									X								RW						F		F	F	F	F
Common Raven	X	CP				X	CP				X	X		CP				X	CP				X		B	F	F	F	F	F	F	FB
Larks																															
Horned Lark	X	CP				X	CP				X	X		CP				X	CP				X				F	FB	F		FB	
Swallows																															
Purple Martin	X				RT								X				O							F	F	F	F	F	F	F	F	F
Tree Swallow	X				CT					CT		X					CT			US		CT		F	F	F	F	F	F	F	F	F
Violet-green Swallow	X				UT					UT		X					CT			US		CT		F	F	F	F	F	F	F	F	F
Northern Rough-winged Swallow	X				UT					UT		X					CT			US		CT		F	F	F	F	F	F	F	F	F
Bank Swallow	X				CT					CT		X					CT			US		CT		F	F	F	F	F	F	F	F	F
Cliff Swallow	X		CS			X		CS			X	X					CT	X		CS			X	F	F	F	F	F	F	F	F	B
Barn Swallow	X		CS			X		CS			X	X					CT	X		CS			X	F	F	F	F	F	F	F	F	B
Chickadees																															
Black-capped Chickadee	X			RW	UT				RW	RT		X				RW						UT			F						F	F
Mountain Chickadee	X			RW									X			RW						RT			F							F
Wrens																															
Rock Wren	X				RT								X									UT									F	
House Wren	X				UT								X				UT					UT			F						F	F
Marsh Wren	X		CS	RW		X		US			X	X			CS			X		CS	UW		X			FB						
Kinglets and Thrushes																															
Ruby-crowned Kinglet	X			UW						RT		X				RW						UT			F						F	F
Blue-gray Gnatcatcher	X				RT								X									RT			F						F	F
Mountain Bluebird	X				RT					RT		X					UT					UT					F	F	F	F	F	
Townsend’s Solitaire	X				RT					RT			X									RT					F		F	F	F	
Hermit Thrush	X				RT								X				RT					UT			F							F
Swainson’s Thrush	X				RT								X				RT								F							F
American Robin	X	UP				X	UP				X	X		UP				X	UP						FB		F	F	F	F		FB
Mimids																															
Gray Catbird	X		RS			X							X												FB							
Northern Mockingbird	X				RT								X							US		RT			F						F	F
Sage Thrasher	X		US			X		RS				X					RT			US		CT	X								FB	

	Migratory Species	GSL Ecosystem					Legacy Parkway Project Study Area							Farmington Bay WMA					Bear River NWR					Habitat Use								
		Seasonal Abundance				Breeds in GSLE	Seasonal Abundance				Breeds in Project Study Area	Documented Occurrence within Project Study Area	Could Potentially Occur within Project Study Area	Seasonal Abundance				Breeds in FBWMA	Seasonal Abundance				Breeds in BRNWR	Open Water	Riparian	Sedge Cattail	Hydric Meadow	Mudflat/Pickleweed	Pasture	Cropland	Salt Desert Scrub	Developed
		P	S	W	T		P	S	W	T				P	S	W	T		P	S	W	T									
Starlings																															
European Starling		CP				X		US	CW		X	X		CP				X	CP				X		FB		F	F	F	F	F	FB
Pipits																															
American Pipit	X			UW	CT					CT		X				UW	CT				UW	CT			F		F	F	F	F		
Waxwings																															
Bohemian Waxwing	X			UW					RW			X				RW					RW				F						F
Cedar Waxwing	X			UW					RW			X				RW					RW				F						F
Wood-Warblers																															
Orange-crowned Warbler	X				RT					RT		X					RT					UT			F					F	F
Nashville Warbler	X				RT					RT		X					RT					RT			F						F
Virginia's Warbler (BCC)	X				RT								X				RT					RT			F					F	F
Yellow Warbler	X				UT					UT		X					UT					UT			F	F				F	F
Yellow-rumped Warbler	X				CT					CT		X					CT					UT			F	F				F	F
Townsend's Warbler	X				RT					RT		X					RT								F						F
American Redstart	X												X												F						F
Northern Waterthrush	X				RT								X				RT								F						
MacGillvray's Warbler	X				UT					RT		X										RT			F	F				F	F
Common Yellowthroat	X		CS		CT	X		US			X	X			CS			X		CS		CT	X		F	FB					
Wilson's Warbler	X				UT					RT		X					RT					UT			F	F				F	F
Tanagers, Grosbeaks and Cardinaline, Buntings																															
Western Tanager	X				RT								X				UT					UT			F						F
Black-headed Grosbeak	X				RT								X				RT					UT			F						F
Lazuli Bunting	X				UT					UT		X					RT					UT			F					F	F
Emberizine Sparrows and Allies																															
Green-tailed Towhee	X				RT								X				RT					UT			F						F
Spotted Towhee	X				UT					RT		X					RT					UT			F					F	F
American Tree Sparrow	X			UW					UW			X				UW					UW				F	F	F	F	F	F	F	F
Chipping Sparrow	X				CT					CT		X					RT					UT			F		F	F	F	F	F	F
Brewer's Sparrow (BCC)	X		CS		CT	X		RS				X					RT			CS		CT	X		F		F	F	F	F	FB	F
Vesper Sparrow	X		US		UT	X				RT		X					RT			CS		CT	X		F		F	F	F	F	F	F
Lark Sparrow	X		US		UT	X				RT		X					RT			US		UT			F		F	F	F	F	F	F
Lark Bunting	X				RT								X									RT									F	
Savannah Sparrow	X		CS		CT	X		US			X	X			CS			X		CS		CT	X				FB		F			
Song Sparrow	X	CP				X	UP				X	X		CP				X	CP				X		FB	F	F		F			F
Lincoln's Sparrow	X				RT					RT		X					RT					UT			F		F		F	F	F	F
Harris' Sparrow	X			RW									X				O				RW				F		F	F	F	F	F	F
White-throated Sparrow	X			RW									X								RW				F		F	F	F	F	F	F
White-crowned Sparrow	X			CW	CT				CW			X				UW					CW	CT			F	F	F	F	F	F	F	F
Dark-eyed Junco	X			CW	CT				CW			X				UW					CW	CT			F	F	F	F	F	F	F	F
Lapland Longspur	X			RW									X								UW						F	F			F	
Snow Bunting	X			RW									X								UW						F	F			F	
Icterids																															
Red-winged Blackbird	X	CP				X	CP				X	X		CP				X	CP				X		F	FB	F	F	F	F		F
Western Meadowlark	X	CP				X	CP				X	X		CP				X	CP				X				F	F	FB	F	FB	F
Bobolink (SPC)	X		RS		RT	X							X									RT					FB		F	F	F	
Yellow-headed Blackbird	X		CS			X		CS			X	X			CS			X		CS			X		F	FB	F	F	F	F	F	F
Brewer's Blackbird	X	UP				X	UP				X	X		CP				X	CP				X		F	F	F	F	FB	FB	F	F
Brown-headed Cowbird	X	CP				X	UP				X	X			RS					CS			X		FB	FB	FB	FB	FB	FB	FB	FB
Northern Oriole	X		US			X		US			X	X			RS							UT			FB							FB
Finches and Old World Sparrows																															
Cassin's Finch	X			RW									X				O								F							F
House Finch	X	CP				X	CP				X	X		CP						CP			X		FB	F	F	F	F	F	FB	FB
Pine Siskin	X			CW					CW			X				UW						UT			F					F	F	F
American Goldfinch	X		RS	CW					UW			X				UW				CP					F	F	F			F	F	F
Evening Grosbeak	X			RW					RW				X				O					RT			F							F
House Sparrow		UP				X			UP		X	X								CP			X		F				F	F		FB
Summary																																
Total number of cells with values	215	38	60	62	109	88	29	34	20	67	51	140	79	32	44	44	96	61	34	62	54	105	59	78	107	79	100	109	103	85	99	107

Table 4.13-1b. Habitat Matrix of Non-Bird Species in the GSLE and Project Study Area

	Species Status						Habitat Use									
	GSLE		LP Project Study Area													
	Occurrence Status	Potential Occurrence	Project Study Area	Breeds in Project Study Area	Documented Occurrence within Project Study Area	Could Potentially Occur within Project Study Area	Open Water	Riparian	Stream/River	Sedge Cattail	Hydric Meadow	Mudflat/Pickleweed	Pasture	Cropland	Salt Desert Scrub	Developed
Fish																
Brown trout	A			P		X			X							
Rainbow trout	A			P		X			X							
Carp	C		C	X	X		X		X	X						
Speckled dace	D			P		X			X							
Long-nose dace	D			P		X			X							
Utah sucker	D			P		X	X		X	X						
Channel catfish	D			P		X	X		X	X						
Bullhead	D			P		X	X		X	X						
White bass	D		C	P		X			X							
Green sunfish	D		C	X		X	X		X	X						
Bluegill	D		C	P		X			X							
Walleye	D		C	P		X			X							
Amphibians																
Tiger salamander	R			P		X				X	X					
Great Basin spadefoot	U			P		X				X	X	X			X	
Woodhouse’s toad	R			P		X		X		X	X		X			
Western chorus frog	C		C	P	X					X	X					
Northern leopard frog	U			P		X			X	X	X					
American bullfrog	U		R	P		X				X	X					
Reptiles																
Common sagebrush lizard	D			P		X									X	
Side-blotched lizard	D			P		X									X	
Desert horned lizard	D		P	P	X										X	
Tiger whiptail	D		P	P	X										X	
Eastern racer	C		C	P	X						X		X		X	
Gopher snake	C		C	P	X			X					X	X	X	
Common garter snake	C		C	P	X			X		X	X		X			
Terrestrial garter snake	D			P	X			X		X	X		X			
Night snake	D		P	P		X									X	
Western rattlesnake	D		P	P		X									X	
Mammals																
Vagrant shrew	D		P	P		X				X						
Masked shrew	D		P	P		X				X						
Preble’s shrew (SPC)	D		P	P		X				X						
Western small-footed myotis		X				X		X		X	X		X		X	
Little brown bat		X				X		X		X	X		X		X	
Long-legged myotis	C					X		X		X	X		X		X	
Western pipistrelle	C					X		X		X	X		X		X	
Big brown bat	C					X		X		X	X		X		X	
Hoary bat		X		P		X		X								
Spotted bat (SPC)	R					X							X		X	
Townsend’s big-eared bat (SPC)	C					X		X		X	X		X		X	
Brazilian free-tailed bat	C			P		X		X		X	X		X		X	
Nuttall’s cottontail		X		P		X							X	X	X	
White-tailed jackrabbit		X		P	X								X			
Black-tailed jackrabbit	C		C	X	X								X	X	X	
Least chipmunk	D		P	P		X		X							X	
Piute ground squirrel	D		P	P		X							X	X	X	
Rock squirrel	C		C	X	X								X	X	X	
Northern pocket gopher		X		P		X		X					X	X		
Botta’s pocket gopher		X		P		X		X					X	X	X	
Great Basin pocket mouse	D		P	P		X									X	
Ord’s kangaroo rat		X		P		X									X	
Beaver	R		R	P		X		X	X							
Western harvest mouse		X		X		X		X					X		X	
Deer mouse	C		C	X	X			X					X	X	X	X
Northern grasshopper mouse	U			P		X									X	
Desert woodrat		X	D	P		X							X		X	
Bushy-tailed woodrat		X	D	P		X							X		X	
Meadow vole	C		C	X	X			X			X		X		X	
Montane vole	D		P	P		X				X	X			X		
Long-tailed vole	D			P		X		X					X			
Sagebrush vole	R		P	P		X									X	
Muskrat	C		C	X	X		X	X	X	X	X					X

	Species Status						Habitat Use									
	GSLE		LP Project Study Area													
	Occurrence Status	Potential Occurrence	Project Study Area	Breeds in Project Study Area	Documented Occurrence within Project Study Area	Could Potentially Occur within Project Study Area	Open Water	Riparian	Stream/River	Sedge Cattail	Hydric Meadow	Mudflat/Pickleweed	Pasture	Cropland	Salt Desert Scrub	Developed
House mouse	C		C	X	X			X					X	X	X	X
Black rat	U			X		X		X								X
Norway rat		X		P	X			X		X	X		X	X		X
Porcupine	R			P		X		X								
Coyote	C		R	X	X							X	X	X	X	X
Red fox	C		C	X	X			X				X	X	X	X	X
Kit fox (SPC)	A					X									X	
Raccoon	C		C	X	X			X		X	X	X	X	X	X	X
Long-tailed weasel	C		R	X	X			X					X		X	X
Mink	U			P		X		X	X	X	X					
Badger	U		D	P		X							X		X	
Spotted skunk	R		R	P	X			X					X			
Striped skunk	C		C	X	X			X				X	X	X	X	X
Mountain lion	R					X										
Bobcat	U			P		X									X	X
Mule deer	C		C	X	X			X		X			X	X	X	
Pronghorn	R			P		X							X		X	
Summary																
Fish (12 species)	12	0	5	12	1	11	5	0	12	5	0	0	0	0	0	0
Amphibians (6 species)	6	0	2	6	1	5	0	1	1	6	6	1	1	0	1	0
Reptiles (10 species)	10	0	7	10	4	6	0	3	0	2	3	0	4	1	8	0
Mammals (50 species)	38	12	25	41	15	35	1	28	3	16	13	4	32	15	34	11

Special-Status Species

- Federally Listed as Threatened
- Federal Candidate Species
- Birds of Conservation Concern
- Conservation Agreement Species
- Wildlife Species of Concern
- Breeds in Project Study Area

Abundance Status

C = Common: Found consistently in fair numbers in appropriate habitat and season
U = Uncommon: Found consistently in small numbers in appropriate habitat and season
R = Rare: Found infrequently bur regularly in very small numbers in appropriate habitat and season
D = Within species range but insufficient data to determine abundance
A = Accidental
X = Column heading status applies

Residence Status

P = Permanent Resident: Found year-round
S = Summer visitant: Present during the nesting season
W = Winter visitant: Present during January and February
T = Transient: Migrates through the area in the spring and/or fall
X = Column heading status applies
(X) = Very few GSLE records; low probability of occurrence at LP Site

Examples of Combined Codes

CP = Common Permanent Resident
RW = Rare Winter Visitant
UT = Uncommon Transient

Habitat Use Codes

F = Foraging Habitat
B = Breeding Habitat
FB = Foraging and Breeding Habitat

Table 4.13-2. Special-Status Wildlife Species of the Legacy Parkway Project Study Area/Great Salt Lake Ecosystem

Species	Migratory Species[1]	GSL Ecosystem: Seasonal Abundance				GSL Ecosystem: Breeds in GSLE	Legacy Parkway Project Study Area: Seasonal Abundance				Legacy Parkway Project Study Area: Breeds in Project Study Area	Legacy Parkway Project Study Area: Documented on Proposed Build Alternative ROWs	Legacy Parkway Project Study Area: Could Potentially Occur on Proposed Build Alternatives ROWs	Habitat Use: Open Water	Riparian	Sedge Cattail	Hydric Meadow	Mudflat/Pickleweed	Pasture	Cropland	Salt Desert Scrub	Developed
		P	S	W	T		P	S	W	T												
Federally Listed Species[2]																						
Bald Eagle (Threatened)	X		RS	CW		X		RS	CW		X	X			FB	F	F	F	F		F	
Federal Candidate Species[2]																						
Yellow-billed Cuckoo	X				RT								(X)		F							F
Conservation Agreement Species[3]																						
Northern Goshawk	X				RT							(x)			F						F	
USFWS Birds of Conservation Concern[4]																						
Swainson's Hawk	X		RS		UT	X		RS			X	X			B		F	F	F	F	F	
Ferruginous Hawk (also SPC species)	X		US		RT								X				F	F	F	F	F	
Golden Eagle	X	RP								RT		X					F	F	F	F	F	
Peregrine Falcon	X	RP				X	RP				X	X				F	F	F	F	F	F	F
Prairie Falcon	X	RP				X	RP					X					F	F	F	F	F	
American Golden-Plover	X				RT								X				F	F	F			
Snowy Plover	X		CS			X							X					FB				
American Avocet	X		CS			X		CS			X	X		F		FB	FB	FB	FB			
Solitary Sandpiper	X				RT					RT		X			F		F	F	F			
Whimbrel	X				RT								X					F	F			
Long-billed Curlew	X		US		CT	X				RT		X					F	FB			FB	
Marbled Godwit	X				CT					RT		X		F			F	F	F			
Sanderling	X			RW	UT								X					F				
Wilson's Phalarope	X		US		CT	X		RS		UT	X	X		F		F	FB	F	F			
Burrowing Owl (also SPC species)	X		RS			X		RS			X		X					F	F		FB	
Loggerhead Shrike	X	UP				X	UP					X			F						FB	F
Virginia's Warbler	X				RT								X		F						F	F
Brewer's Sparrow	X		CS		CT	X		RS				X			F		F	F	F	F	FB	F
Utah DWR Wildlife Species of Concern[3]																						
American White Pelican	X		CS			X		RS					X	F		F						
Short-eared Owl	X	CP				X	UP				X	X				F	F	F	F	F	FB	
Bobolink	X		RS		RT	X							X				F		F	F	F	
Preble's shrew		D											(x)				X					
Spotted bat		R											X		X		X	X		X		X
Townsend's big-eared bat		C											X		X		X	X		X		X
Kit fox		A											X								X	
Summary: Total number of cells with values	24	9	11	2	14	14	4	7	1	5	7	14	14	4	10	6	18	20	16	10	14	7

[1] Species identified in the Migratory Bird Treaty Act
[2] Species listed under the Endangered Species Act
[3] UDWR (2003)
[4] USFWS (2002)

Bird Codes

Abundance Status

C = Common: Found consistently in fair numbers in appropriate habit and season
U = Uncommon: Found consistently in small numbers in appropriate habitat and season
R = Rare: Found infrequently but regularly in very small numbers in appropriate habitat and season

Residence Status

P = Permanent Resident: Found year-round
S = Summer visitant: Present during the nesting season
W = Winter visitant: Present during January and February
T = Transient: Migrates through the area in the spring and/or fall
X = Column heading status applies
(X) = Very few GSLE records; low probability of occurrence at Legacy Parkway project study area

Habitat Use Codes

F = Foraging Habitat
B = Breeding Habitat
FB = Foraging and Breeding Habitat

Codes for Amphibians, Reptiles, and Mammals

C = Common
R = Rare
D = Within species range but insufficient data to determine abundance
A = Accidental
X = Column heading status applies

As discussed in the Final EIS, the predominance of migratory birds that use the GSLE highlights the ecological importance of this area to these species (Jones & Stokes 2005). Great Salt Lake, with its unique mosaic of wetland, upland, mudflat, river delta, brackish and freshwater marsh, and ephemeral pond habitats, has long been recognized for its importance to migratory birds (Behle 1958, Knopf 1975, Jehl 1988, Paton 1994, Shuford et al. 1995, Paul and Manning 2002). These habitats, and the ecological features of this large inland oasis, provide important refuge and resources for up to approximately 5 million birds a year. The wetlands of Great Salt Lake that these birds use account for 75 percent of all wetlands in Utah (Jensen 1974). The GSLE is internationally important because it is an integral part of the Pacific and Central Flyways for migratory waterfowl and is a key link of the Western Hemisphere Shorebird Reserve Network. Brine shrimp (*Artemesia fransiscana*) and brine flies (*Ephydra cinerea*) produced in Great Salt Lake provide a vital food source for these birds.

4.13.2.4 Existing Wildlife Habitats in Project Study Area

The proposed Legacy Parkway project alignments cross a complex of wetlands and uplands that includes the following habitat types.

- Wetland/riparian wildlife habitat categories.
  - Open water.
  - Riparian.
  - Sedge cattail.
  - Hydric meadow.
  - Mudflat/pickleweed.
- Upland wildlife habitat categories.
  - Pasture.
  - Cropland.
  - Salt desert scrub.
  - Developed (including urban landscaping).

Figure 4.13-5 shows the distribution of these habitats in the project study area. Figure 4.13-6 shows the total acreage of each habitat. Detailed descriptions of each habitat and their associated wildlife are presented in Section 2.4.1 of the wildlife technical memorandum.

The amounts of direct loss of wetland/riparian habitat quantified in this Supplemental EIS differ from the extent of direct loss of jurisdictional wetlands specified in Section 4.12, Wetlands, and the Final EIS. These differences are primarily the result of a dissimilarity between the habitat classification system developed by the wildlife technical team for the wildlife technical memorandum and the classification system used to identify jurisdictional waters (including wetlands). Specifically, the wildlife technical memorandum examined wildlife habitats, whereas the wetland delineation follows Corps delineation standards. Accordingly, open water and riparian habitats have been mapped differently for purposes of the

wildlife habitat analysis; consequently, the habitats mapped for this analysis include areas excluded from the wetland delineation in the Final EIS analysis because they did not qualify as jurisdictional waters. Moreover, the mapping undertaken in the preparation of the wildlife technical memorandum encompassed all habitats in the project study area, resulting in a different dataset than that produced for the wetland delineation. The mapping methodologies are discussed in detail in Appendix B of the wildlife technical memorandum.

The wetland/riparian habitats around the lake are formed and maintained by a complex interplay of surface and subsurface fresh water and the fluctuating dynamics of Great Salt Lake's surface elevation. Many of the habitats directly associated with the shoreline, such as mudflats, nearshore playas, and sedge cattail habitats, develop and subside with the rise and fall of the lake. Other more interior habitats, including hydric meadows, permanent and ephemeral ponds, and riparian corridors, are more responsive to seasonal precipitation patterns and fluctuations in the water table. The upland habitats are more stable, providing important refuge, resting, and foraging habitat for many species, particularly when the lake level is high and the lower elevation habitats are flooded.

4.13.2.5 Existing Conditions Related to Wildlife Habitats in Project Study Area

This section describes the following existing conditions in relation to wildlife habitat in the project study area.

- Habitat fragmentation.
- Habitat quality (water and air).
- Wetland hydrology.
- Artificial landscaping.
- Wildlife mortality.
- Noise.
- Artificial light.
- Human disturbance.

Existing Habitat Fragmentation

By definition, habitat fragmentation results in the formation of smaller patches of habitat where larger, more contiguous patches once existed (Meffe et al. 1997). As a result of fragmentation, a larger population of a species that inhabited the original patch may become divided into several smaller subpopulations that are connected only by movement of individuals migrating between disjunct patches rather than along contiguous habitat (Primack 2000). Habitat fragmentation results in direct habitat loss and in changes in the geometry and biological connectivity between patches (Meffe et al. 1997). These changes can result in modifications of the availability and suitability of habitat to extant wildlife in an affected area. Over time, extinction rates in smaller, more isolated populations are generally higher than those in larger populations because of loss of genetic variation, inbreeding, genetic drift, and greater

susceptibility to random population fluctuations and environmental changes, all of which ultimately affect the long-term viability of wildlife populations (Soulé 1987; Forman 1995; Primack 2000). However, such effects are most likely to impact relatively sedentary species with low dispersal capabilities such as amphibians, reptiles, small mammals, and many invertebrates.

The existing habitats within the project study area exhibit extensive fragmentation today due to previous construction of railroad corridors (UPRR and D&RG), I-15, and many smaller roads, as well as other previous development and disturbance (e.g., farming, grazing, dikes, and fences) in many areas in the project vicinity. These and other land use changes in the project study area and the GSLE have resulted in marked fragmentation of wildlife habitats along the Wasatch Front. In particular, these changes have resulted in movement barriers to wildlife between the Wasatch Mountains and Great Salt Lake. Rural and urban road networks in the intervening uplands, agriculture, and development have also significantly fragmented historic wildlife habitats in the GSLE. The wildlife populations now present in these areas are likely to have already experienced many of the population changes typically associated with habitat fragmentation (e.g., reduced carrying capacity, lower reproductive success, higher susceptibility to predation). However, aside from GIS information documenting habitat changes, no data are available to substantiate or detail these changes. Existing conditions represent highly modified populations from historic times. Based on observed changes in other fragmented wildlife populations described in the literature (e.g., Soulé 1987; Forman 1995; Primack 2000), it is presumed that wildlife in the project study area has experienced reduced species diversity, population densities, and distributions in response to cumulative long-term effects of these land use changes.

Existing Habitat Quality

Section 4.10, *Water Quality*, provides an updated description of water quality in the study area, as described in Section 4.0.1, *Study Area*. Relative to existing wildlife habitat quality, since publication of the Final EIS, the Jordan River has been listed as an impaired water that does not meet Class 3B (warm-water species of game fish) or Class 3C (non-game fish) standards under the Clean Water Act because of low dissolved oxygen.

As described in Section 4.8, *Air Quality*, air quality in the project and regional study areas is generally considered good. The air quality monitoring stations nearest the project study area are in North Salt Lake and Ogden. Levels of ozone, sulfur dioxide, carbon monoxide, and particulate matter (PM10 and PM2.5) are monitored at these stations. Salt Lake and Davis Counties are designated maintenance areas for ozone (1 hour-average) Salt Lake County is in moderate nonattainment for PM10. PM10 monitoring data indicate that the PM10 standard has not been exceeded in Salt Lake County since 1994 (Bird pers.comm).

Existing Wetland Hydrology

The hydrology of the project study area is a function of both seasonal and spatial patterns of water flow, both on the surface and underground. The surface water bodies within the project study area include the Jordan River, nine creeks, wetlands associated with Great Salt Lake, and several ditches and canals.

The Jordan River meanders for approximately 93 river km (58 river mi) from the outlet of Utah Lake north to Great Salt Lake. Each of the Jordan River's seven major tributaries (Little Cottonwood Creek, Big Cottonwood Creek, Mill Creek, Parley's Creek, Emigration Creek, Red Butte Creek, and City Creek) originates in the Wasatch Mountains and flows west to the Jordan River. No major streams originate in the western side of the valley. The watershed drains a total area of about 2085 square km (805 square mi).

Many of the wetlands in the project study area respond to a shallow water table associated with groundwater discharge and periodic precipitation. As described in Section 4.10, Water Quality, the project study area is located over a multilayered groundwater flow system consisting of a shallow

unconfined aquifer and a deeper principal aquifer that is part of a larger aquifer system on the eastern shore. The depth of the shallow groundwater varies between 0 and 3 m (9 ft). The principal aquifer lies at a depth of approximately 60 m (200 ft) and is separated from the shallow groundwater by a layer of fine-grained soil of varying thickness. It is recharged primarily by precipitation at the base of the Wasatch Mountains outside the project study area. Subsurface groundwater flow generally moves from this recharge area westward toward Great Salt Lake, but there is also an equal or greater component of vertical flow from deeper confined zones of the principal aquifer (Forster and Neff 2002).

Substantial modification of the natural surface hydrology of the wetlands associated with the Jordan River Delta has occurred with the creation and management of numerous duck clubs and the Farmington Bay Waterfowl Management Area (FBWMA). These changes have benefited many migrating waterfowl and shorebird species through enhancement of wetlands formerly affected by historic water diversion and management projects.

Existing Artificial Landscaping in Project Vicinity

Portions of the project study area have been artificially landscaped in residential, commercial, and industrial areas. Some of this landscaping also exists in rural residential areas, including around ranch houses and other ranch buildings. Artificial landscaping incorporates many nonnative and native trees, shrubs, and other vegetation. The urban landscaping in the project study area provides useable habitat for a variety of native and introduced migratory species.

Existing Sources of Direct Wildlife Mortality in Project Vicinity

There is little information on existing sources of wildlife mortality within the project study area. Aside from natural causes of death, such as predation, disease, and limited longevity, there is undoubtedly some roadkill associated with existing roads in the area, particularly for amphibians, reptiles, and small mammals found in adjacent habitats, as well as predatory birds and mammals that may be attracted to the carcasses.

Existing Sources and Levels of Noise in Project Vicinity

The noise levels within the project study area were sampled July 1 to 2, 2003, to estimate existing conditions. This analysis included both short-term (1-hour) and long-term (3-day) measurements at various locations within the project study area (Figure 4.13-7) and up to approximately 6 km (3.7 mi) beyond the project study area. Existing noise levels in the project study area are elevated by traffic noise from I-15, wind, and aircraft overflights from Salt Lake City International Airport. As illustrated in Tables 4.13-3 and 4.13-4, although existing background noise levels in the project vicinity are generally low, maximum short- and long-term noise levels were measured at levels as high as 79 dBA and 78 dbA, respectively. A complete discussion of the noise impacts analysis is provided in Section 4.9, *Noise*.

Existing Sources of Artificial Light in Project Vicinity

Increased lighting can affect wildlife in a variety of ways, both positive and negative. Some species such as bats may benefit from artificial light because it attracts aerial insects, their primary prey. Artificial light may also benefit various predators such as foxes by making prey species such as mice more visible at night. Other species, including some fish, amphibians, birds, mammals, and invertebrates, may have their diurnal or reproductive cycles interrupted or may experience direct mortality and increased predation rates because of artificial light.

The project study area is affected by artificial lighting from residential and commercial developments in the greater Salt Lake City region. Some of the major industrial sources of artificial light in the project vicinity are listed below.

- Chevron USA, Inc. petroleum refinery in Salt Lake City.
- Amoco Oil Company petroleum refinery in Salt Lake City.
- Tesoro petroleum refinery in Salt Lake City.
- Flying J petroleum refinery in North Salt Lake.
- Portland Cement plant in North Salt Lake.
- Phillips 66 petroleum refinery in Woods Cross.
- Crysen Refining petroleum refinery in Woods Cross.
- Golden Eagle Refinery, Inc. petroleum refinery in Woods Cross.
- Utah Power and Light substation in Centerville.
- Salt Lake City International Airport, located just west of the project's southern terminus (runway, building, and control tower lights, as well as aircraft lights).

Existing Sources of Human Disturbance in Project Vicinity

Human disturbance can have adverse effects on wildlife, and many bird species are sensitive to some level of direct disturbance of their nest sites or intrusions into their nesting territories. Portions of the project study area have already been converted to residential, commercial, and industrial uses; wildlife using these areas often experiences frequent disturbance from human activities and domestic pets. Human and domestic pet access to the wildlife habitat within the project study area would likely result in some level of habitat degradation and wildlife mortality; domestic and feral cats pose a particular threat to wildlife (especially avian) mortality.

Other portions of the project study area are currently low-density, rural residential areas or ranches. In those areas, potential human sources of wildlife disturbance include vehicle traffic on the unsurfaced roads and off-highway vehicle use in unroaded areas. The grazing, trampling, etc. of cattle and horses also are likely to remove cover and alter species habitat. In addition, unauthorized hunting and shooting may occur in some areas and can result in direct wildlife mortality.

Table 4.13-3 Short-Term Sound Level Measurements

Recording Location	Date	Start Time	Duration (min)	Average Wind Speed (mph)	Leq[1]	Lmin[2]	L90[3]	L50[3]	L10[3]	Lmax[4]	Distinct Noise Sources
5	1 Jul	12:43	16:00	8.4	52.2	41.8	43.9	47.1	53.5	67.3	Vehicle passages, crickets, wind in vegetation
6	1 Jul	13:50	16:00	11.6	52.3	40.2	44.8	49.3	56.3	62.6	Aircraft, wind in vegetation
7	1 Jul	14:48	10:00	14.8	52.3	45	47.1	51.3	55.1	66.6	Wind in vegetation, no audible human sound
8	1 Jul	15:36	15:00	8.6	59.5	39.2	42.3	48	60.5	79.1	Vehicle passages, distant traffic, aircraft, wind in vegetation
9	1 Jul	18:40	18:00	11.1	48.3	32.2	39.7	44.7	52.4	60.9	Wind in vegetation, aircraft
10	1 Jul	19:20	15:00	2.7	59.9	33.2	36.2	45	62	76.5	Aircraft, birds
11	1 Jul	19:59	15:00	4.4	51.9	33.1	40.2	45.4	51.5	71.4	Aircraft, birds
12	2 Jul	7:02	19:00	2.2	43.9	32	33.7	36.1	44	61.6	Aircraft, birds
13	2 Jul	7:57	14:00	2.8	46.8	39.8	41.8	43.4	46.6	61	Aircraft, distant birds
1	2 Jul	9:36	17:00	1.2	42.6	33.4	36.5	40.6	45.8	52.6	Aircraft, birds
2	2 Jul	10:33	18:00	2.9	45.1	31.2	33.8	40.8	49.2	57.1	Aircraft, crickets
6	2 Jul	12:33	15:00	4.1	40.8	31.7	33.8	36.7	42.1	57.6	Wind in vegetation, birds, aircraft
14	2 Jul	13:29	16:00	4.5	47.2	31.8	33.7	36.6	52.3	61.2	Wind in vegetation, birds, aircraft
4	2 Jul	14:53	15:00	4.8	37.1	30.8	31.6	33.6	38.4	53.1	Distant construction activity, aircraft
				Mean	48.6	35.4	38.5	42.8	50.7	64.3	
				STDEV	6.6	4.7	5.0	5.5	6.8	7.6	
				Min	37.1	30.8	31.6	33.6	38.4	53.1	
				Max	59.9	45	47.1	51.3	62	79.1	
				Range	22.8	14.2	15.5	17.7	23.6	26.0	

[1] **Leq.** Equivalent Sound Level. The equivalent steady-state sound level that, in a stated period of time, would contain the same acoustical energy.
[2] **Lmin.** Minimum Sound Level. The minimum sound level measured during the measurement period.
[3] **Lxx.** Percentile-Exceeded Sound Level. The sound level exceeded "x" percent of a specific time period. L10 is the sound level exceeded 10 percent of the time.
[4] **Lmax.** Maximum Sound Level. The maximum sound level measured during the measurement period.

Table 4.13-4 Mean, Standard Deviation, Minimum, and Maximum Noise Levels

SPL[1] (dBA)[2]	Leq[3]				L10[4]				L50[4]				L90[4]			
	L1	L2	L3	L1–L3	L1	L2	L3	L1–L3	L1	L2	L3	L1–L3	L1	L2	L3	L1–L3
Mean	53	45	52	50	55	48	54	51	47	41	46	45	43	36	41	40
SDEV	11	8	8	10	11	8	9	11	8	7	8	8	7	5	6	7
Minimum	41	36	40	36	42	37	41	35	37	34	36	34	36	32	35	32
Maximum	78	69	71	78	81	73	75	81	71	67	69	71	65	58	64	65

[1] **SPL.** Sound Pressure Level.
[2] **dBA.** A-Weighted Decibel. An overall frequency-weighted sound level in decibels that approximates the frequency response of the human ear.
[3] **Leq.** Equivalent Sound Level. The equivalent steady-state sound level that, in a stated period of time, would contain the same acoustical energy.
[4] **Lxx.** Percentile-Exceeded Sound Level. The sound level exceeded "x" percent of a specific time period. L10 is the sound level exceeded 10 percent of the time.

4.13.3 Environmental Consequences and Mitigation Measures

This section discloses potential direct, indirect, and cumulative effects of each project alternative on wildlife, including species of concern to federal agencies and the State of Utah. As described in Section 4.0.3, *Alternatives Evaluated*, the alternatives analyzed in this document represent modifications, based on a reduced right-of-way width of 95-m (312-ft), of the alternatives analyzed in the Final EIS.

As disclosed in the Final EIS, all the proposed build alternatives would adversely affect wildlife populations and their upland and wetland/riparian habitats in the project study area. In addition, since publication of the Final EIS, construction activities associated with Alternative D (Final EIS Preferred Alternative) and new development unrelated to the proposed action have affected wildlife habitat in the project study area. This section provides an updated discussion of the following wildlife impacts for each proposed build alternative; these impacts are examined in more detail in the wildlife technical memorandum.

- Direct habitat loss.
- Changes in habitat availability relative to changes in lake level.
- Habitat fragmentation.
- Changes in habitat quality, including
  - air quality and
  - water quality.
- Habitat modification, including

  - wetland hydrology and
  - artificial landscaping.
- Wildlife mortality.
- Artificial light disturbance.
- Highway noise disturbance.
- Human disturbance.
- Effects on wildlife species of concern.
- Cumulative effects.

In summary, the adverse direct, indirect, and cumulative effects described in this section would contribute to declines in the amount of available wildlife habitat and would likely result in declines in local density of affected species. In addition, traffic noise could potentially affect the behavior and reproductive capacity of various migratory bird species in the project study area and parts of the regional study area.

The area of wildlife habitat affected by direct habitat loss would be small—approximately 0.1 percent of the total amount of wildlife habitat available throughout the regional study area. Highway noise would affect a larger area—approximately 1.3 percent of existing wildlife habitat in the regional study area. Loss or degradation of these areas of wildlife habitat and diminution of biological functions of certain species (e.g., reproductive capacity of birds affected by noise) would add to the cumulative historic and foreseeable future habitat loss and associated impacts on wildlife in the GSLE. The impacts resulting from the proposed action alone, however, would not likely affect the long-term viability of any wildlife species in the GSLE.

4.13.3.1 Direct Habitat Loss

Construction of any build alternative would result in direct loss of wildlife habitat in the project right-of-way or footprint. Habitat losses would be caused by such activities as excavation, grading, highway construction, and development and use of staging and access areas. The extent and character of these losses would be a function of the location of the alignment within the matrix of habitats in the project study area and the placement of the highway footprint within the right-of-way in relation to sensitive habitats.

Total Available Habitat

The total amount of each habitat that occurs in the project area is shown above in Figure 4.13-6. Upland habitats (pasture, cropland, and salt desert scrub) comprise much larger areas than do wetland/riparian habitats (hydric meadow, sedge cattail, mudflat/pickleweed, open water, and riparian). Pasture is the most extensive upland habitat; hydric meadow is the most extensive wetland/riparian habitat. Developed lands are excluded from this discussion because construction of any build alternative would cause a net increase of this habitat category.

As explained in Footnote 3 above, the mapping methodology for the wildlife analysis accounts for the differences between the apparent extent of habitats described in Section 4.12, *Wetlands*, and this section.

Wetland/riparian habitats used for the wildlife analysis include delineated wetlands and non-delineated riparian areas. Including these habitats in the wetland/riparian category enabled the wildlife analysis to focus on land areas actually used by wildlife, rather than areas defined strictly by the technical wetland delineation boundaries.

No-Build Alternative

Existing Conditions (2004)

Under the existing conditions No-Build Alternative, there would be no project-related loss of wildlife habitat in the project study area. There also would be no mitigation in the form of the proposed Legacy Nature Preserve, which is described below in Section 4.13.3.14.

Future Conditions (2020)

Even without construction of Legacy Parkway, under the future conditions No-Build Alternative, reasonably foreseeable future land use changes would add to the historic loss and fragmentation of wildlife habitat (see Section 4.13.2.2, *Historic Habitat Conditions*). Approximately 47 percent of the wetland/wildlife habitat remaining in the regional study area (55,002 ha [135,915 ac] of 117,027 ha [288,181 ac]) is on private land, which is subject to reasonably foreseeable future land use changes. The percentage of historical wetland/wildlife habitat remaining in the region varies locally by hydrologic unit, as described above in Section 4.13.2.2.

Table 4.13-5 illustrates the potential impact of future development on wetland/wildlife habitat in the study area, both with and without the proposed build alternatives. Two categories of development were identified to illustrate potential impacts of future development in the project study area: areas developed subsequent to 1997 (developed), and areas potentially developable in the future (developable).[3] As indicated in Table 4.13-5, the Legacy Parkway project is not the only potential source of future loss of wetland/riparian and upland habitats. For example, in 1997 there were approximately 839.2 ha (2,073.7 ac) of developable pastureland in the project study area. Since 1997, 269.2 ha (665.2 ac) of pasture, or 47 percent of this acreage, were developed as a result of other actions in the project study area not related to the Legacy Parkway project. It is possible that areas designated as developable could be set aside as protected in the future. Areas west of the critical protection areas line (Figure 4.13-8) have been designated as priority lands for conservation in the *Wetlands Preservation Plan: a Plan for Protection of the Great Salt Lake Wetlands Ecosystem in Davis County* (Wetland Protection Plan Steering Committee 1996).

[3] As noted in Table 4.13-5, the term *developable lands* does not include any jurisdictional wetlands or land below the FEMA floodplain elevation of 4,212 feet.

Table 4.13-5 Potential Impact (acres) of Future Development and the Build Alternatives in the Project Study Area

Habitat	Total Project Study Area	Build Out		Alternative A and Build Out		Alternative B and Build Out		Alternative C and Build Out		Alternative E and Build Out	
		Developed[1]	Developable[2]	Developed	Developable	Developed	Developable	Developed	Developable	Developed	Developable
Pasture	2,908.7	665.2	1,408.9	827.1	1,280.7	903.6	1,264.1	841.5	1,277.5	850.7	1,267.0
Cropland	1,725.1	312.0	995.4	433.1	882.1	524.1	847.6	413.3	916.0	421.7	896.6
Scrub	1,260.7	145.8	531.4	258.0	462.2	210.5	510.0	281.2	464.4	258.1	465.3
Hydric Meadow	1,161.4	87.4	28.7	153.0	27.2	173.8	26.0	175.2	24.8	157.3	22.5
Sedge cattail	709.5	64.0	0.0	72.9	0.0	92.3	0.0	80.8	0.0	74.5	0.0
Mudflat/Pickleweed	439.8	12.2	0.0	17.8	0.0	28.5	0.0	43.5	0.0	27.8	0.0
Open Water	284.8	13.1	0.9	21.4	0.7	28.2	0.9	13.6	0.9	21.8	0.7
Riparian	70.9	18.4	11.2	20.5	10.5	20.9	10.3	22.2	10.7	21.0	10.4
Developed	1,783.3	1,109.3	251.8	1,166.9	234.0	1,165.6	235.5	1164.6	234.8	1,166.8	234.6
Total Upland[3]	5,894.5	1,123.0	2,935.8	1,518.2	2,625.0	1,638.2	2,621.7	1,535.9	2,657.9	1,530.5	2,628.9
Total Wetland[4]	2,310.7	163.6	28.7	243.7	27.2	294.5	26.1	299.5	24.8	259.6	22.6
Total[5]	10,344.2	2,427.5	3,228.4	2,970.8	2,897.4	3,147.4	2,894.4	3,035.8	2,929.0	2,999.8	2,897.1

[1] *Developed* refers to areas developed since 1997.

[2] *Developable* refers to areas within the project study area (including the Legacy Nature Preserve) that were identified as undeveloped as of 2005; it does not include jurisdictional wetlands; land below the FEMA floodplain elevation of 4,212 ft; or lands owned by duck clubs, used for recreation, or owned by state or federal government.

[3] *Total Upland* comprises desert salt scrub, cropland, and pasture.

[4] *Total Wetland* comprises sedge cattail, hydric meadow, and mudflat/pickleweed.

[5] *Total* is the sum of all habitat types.

Build Alternatives

The total area of upland, wetland/riparian, and combined habitats that would be directly lost as a result of each build alternative is described below and summarized in Figure 4.13-9.

Alternative A

Alternative A would result in the following direct habitat loss within the right-of-way.

- Loss of 46.6 ha (115.1 ac) of wetland/riparian habitat, comprising
  - 29.7 ha (73.3 ac) of hydric meadow,
  - 9.1 ha (22.6 ac) of sedge cattail,
  - 2.5 ha (6.2 ac) of mudflat/pickleweed,
  - 3.7 ha (9.1 ac) of open water, and
  - 1.6 ha (3.9 ac) of riparian habitat.
- Loss of 195.3 ha (482.5 ac) of upland wildlife habitat, comprising
  - 85.0 ha (210.0 ac) of pasture,
  - 57.3 ha (141.7 ac) of cropland, and
  - 52.9 ha (130.8 ac) of salt desert scrub habitat.

The total amount of land in the developed habitat category in the Alternative A right-of-way would be 119.8 ha (296.1 ac).

Alternative B

Alternative B would result in the following direct habitat loss within the right-of-way.

- Loss of 78.8 ha (194.6 ac) of wetland/riparian, comprising
  - 41.7 ha (103.0 ac) of hydric meadow,
  - 19.9 ha (49.2 ac) of sedge cattail,
  - 7.5 ha (18.6 ac) of mudflat/pickleweed,
  - 7.4 ha (18.2 ac) of open water, and
  - 2.3 ha (5.6 ac) of riparian habitat.

- Loss of 261.9 ha (647.1 ac) of upland wildlife habitat, comprising
  - 129.6 ha (320.3 ac) of pasture,
  - 100.1 ha (247.3 ac) of cropland, and
  - 32.2 ha (79.6 ac) of salt desert scrub habitat.

The total amount of land in the developed habitat category in the Alternative B right-of-way would be 109.0 ha (269.4 ac).

Alternative C

Alternative C would result in the following direct habitat loss within the right-of-way.

- Loss of 63.3 ha (156.5 ac) of wetland/riparian habitat, comprising
  - 39.7 ha (98.1 ac) of hydric meadow,
  - 8.1 ha (20.0 ac) of sedge cattail,
  - 12.9 ha (32.0 ac) of mudflat/pickleweed,
  - 0.6 ha (1.4 ac) of open water, and
  - 2.0 ha (4.9 ac) of riparian habitat.
- Loss of 188.7 ha (466.2 ac) of upland wildlife habitat, comprising
  - 79.3 ha (196.0 ac) of pasture,
  - 47.7 ha (117.8 ac) of cropland, and
  - 61.7 ha (152.5 ac) of salt desert scrub habitat.

The total amount of land in the developed habitat category in the Alternative C right-of-way would be 100.8 ha (249.0 ac).

Alternative E

Alternative E would result in the following direct habitat loss within the right-of-way.

- Loss of 52.4 ha (129.5 ac) of wetland/riparian wildlife habitat, comprising
  - 30.6 ha (75.6 ac) of hydric meadow,
  - 9.8 ha (24.3 ac) of sedge cattail,
  - 6.6 ha (16.3 ac) of mudflat/pickleweed,
  - 3.9 ha (9.6 ac) of open water, and

- 1.5 ha (3.8 ac) of riparian habitat.

- Loss of 185.5 ha (458.3 ac) of upland wildlife habitat, comprising
  - 81.7 ha (201.8 ac) of pasture,
  - 52.3 (129.3 ac) of cropland, and
  - 51.5 ha (127.2 ac) of salt desert scrub.

The total amount of land in the developed habitat category in the Alternative E right-of-way would be 112.1 ha (277.1 ac).

Regional Context: Proportion of Available Habitat Loss under Build Alternatives

As described in Section 4.13.2, although all the wildlife habitats found in the project study area are also found in other areas of the GSLE, the project study area is located within a system of extensive wetlands that includes the Jordan River Delta and the FBWMA, which is used by many thousands of migratory birds each year. In total, the project study area represents 0.88 percent of the regional study area, and 0.8 percent of the wildlife habitat in the region is located in the project study area. Table 4.13-6 presents a summary of the acreage of each habitat type in the project and regional study areas for each project alternative.

Table 4.13-6 Areal Comparison of Build Alternatives within Regional Study Area[1]

	Regional Study Area	Project Study Area		Alternative A		Alternative B		Alternative C		Alternative E	
Habitat	acres	acres	%	acres	%	acres	%	acres	%	acres	%
Cropland	285,165	3,372	1.18	318	0.11	351	0.12	213	0.07	264	0.09
Developed	113,742	83	0.07	1	0.00	3	0.00	1	0.00	1	0.00
Sedge cattail	206,017	2,469	1.20	270	0.13	283	0.14	293	0.14	278	0.14
Mudflat/Pickleweed	22,084	707	3.20	79	0.36	101	0.46	64	0.29	71	0.32
Pasture	159,416	467	0.29	107	0.07	111	0.07	105	0.07	107	0.07
Riparian	99,139	1,203	1.21	56	0.06	87	0.09	70	0.07	61	0.06
Scrub	42,817	1,212	2.83	27	0.06	110	0.26	86	0.20	45	0.11
Unclassified	184,915	341	0.18	3	0.00	12	0.01	17	0.01	3	0.00
Upland	3,728	8	0.20	0	0.00	1	0.02	0	0.01	0	0.00
Hydric Meadow	11,283	67	0.60	23	0.20	24	0.22	26	0.23	23	0.20
Total Wetland[2]	604,923	5,924	0.98	589	0.10	637	0.11	507	0.08	543	0.09
Total Upland[3]	326,871	2,756	0.84	86	0.03	209	0.06	173	0.05	109	0.03
Total[4]	1,128,305	9,929	0.88	885	0.08	1,084	0.10	874	0.08	853	0.08

Notes:
[1] Areal calculations are based on regional-scale data. Refer to the cumulative impacts analysis and Appendix B of the wildlife technical memorandum for a discussion of data limitations.
[2] *Total Wetland* comprises sedge cattail, hydric meadow, and mudflat/pickleweed.
[3] *Total Upland* comprises desert salt scrub, cropland, and pasture.
[4] *Total* is the sum of all habitat types

The wildlife technical memorandum provides a detailed discussion of the contribution of the Legacy Parkway project to habitat loss in the region. Less than 0.1 percent of regionally available wildlife habitat around Great Salt Lake that is used by migratory species would be directly lost under any build alternative. The percentage lost per alternative is summarized in Table 4.13-7 to provide the regional context for this habitat loss.

Table 4.13-7 Percentage of Regionally Available Wildlife Habitat Loss by Alternative

Alternative	Wetland/Riparian Habitats	Upland Habitats
No-Build (Existing Conditions)	0.0%	0.0%
Alternative A	0.026%	0.097%
Alternative B	0.063%	0.105%
Alternative C	0.052%	0.084%
Alternative E	0.033%	0.090%

4.13.3.2 Changes in Lake Level and Habitat Availability

No-Build Alternative

Existing Conditions and Future Conditions

As the level of Great Salt Lake rises through natural processes, existing terrestrial habitats are inundated and converted to saline, open water habitat. The lake reached a historic high of approximately 1,283.8 m (4,211.8 ft) in 1986–1987, and a low of 1277.4 m (4,191 ft) in 1963 (Aldrich and Paul 2002). As the lake level rises, the total amount of available terrestrial habitat within the project study area decreases. As the lake level naturally recedes, the former ecological communities regenerate slowly. (See Section 4.12.2.3, *Wetlands and Great Salt Lake Flooding,* for a discussion of how inundation levels of Great Salt Lake affect wetland habitats.) These conditions would continue to exist under the No-Build Alternative.

The level of Great Salt Lake (1997 average level = 4200.3 ft; 2003 average level = 4197.6 ft.) is expected to rise and fall in the future, and effects of this natural phenomenon are expected to be similar to those described above under existing conditions.

Build Alternatives

To account for the dynamics of the level of Great Salt Lake, the combined effects of natural inundation from changes in lake level and implementation of each build alternative were examined to determine how these factors act in concert to affect the temporal pattern of overall availability of wildlife habitats within the project and regional study areas. Figures 4.13-10 and 4.13-11 show the areal extent of available habitats in the project and regional study areas at low and high lake levels. These data show relatively little change in upland habitats (pasture, cropland, scrub) with lake level change, but the availability of wetland habitats (hydric meadow, sedge cattail, and mudflat/pickleweed) is markedly reduced at high lake levels. Regionally, at high water there is a 64 percent reduction in both mudflat/pickleweed habitat and sedge cattail habitat, a 30 percent change in hydric meadow, and a 15 percent reduction in available riparian habitat.

Table 4.13-8 shows the acreage of each habitat that would be lost under each alternative and the percentage of regionally available habitat the lost area represents at low and high lake levels. Proportionally, the amount of any habitat that would be lost under any proposed alternatives is very small at both low lake level (<0.3 percent) and high lake level (<0.6 percent). Because of the very large area of habitat available regionally and the comparatively small area of the proposed action, the change in lake level does not measurably affect the proportion of habitat lost under each alternative, even though the level of the lake can cause up to a 64 percent change in the regional availability of habitat. The largest proportional change in any habitat between low and high lake level is only 0.3 percent (sedge cattail, Alternative B). This level of change, while calculable, is insignificant with regard to the inherent error of the GIS polygon measurement methodology.

At the project study area level, the change in the areas of habitats that would be lost to the proposed action (Figure 4.13-10, Table 4.13-9) is proportionally greater at both low and high lake levels than that described above for the regional level (Table 4.13-8). For example, mudflat/pickleweed habitat lost under Alternative C changes from 5 percent of the available habitat in the project study area at low lake level to 27 percent of the habitat in the project study area at high lake level—a change of 22 percent. Under Alternative B, sedge cattail habitat changes 11 percent from 9 percent at low lake level to 20 percent at high lake level. Changes in other habitats are all smaller. These project study area changes represent the local effects of lake level change on habitat availability. As with the regional analysis, the greatest changes in wetland habitats are at the lower elevations.

The principal ecological effects of the dynamics of the combined effects of lake level changes and habitat loss associated with the build alternatives are summarized below. The corresponding discussion in the Section 3.2, *Combined Effects of Lake Level Change and Habitat Loss Associated with Build Alternatives,* of the wildlife technical memorandum provides a more detailed discussion of these effects.

- Except for open water habitat, the alignments of the different project alternatives are located such that the highest levels of impact from habitat loss occur mostly in the middle elevation zones (1,281.4–1,282.6 m [4,204–4,208 ft] and 1,282.6–1,283.8 m [4,208–4,212 ft]). This is characteristic of both wetland/riparian and upland habitats. Open water habitat (fresh water) is mostly affected in the lower inundation zones

- The probability of inundation, as estimated from historic conditions (pre-settlement; before 1847), is highest for the two inundation zones below 1,282.6 m (4,208 ft) (24–33 percent for these zones, contrasted with 1.7–8.3 percent for zones above 1,282.6 m [4,208 ft]). This trend indicates that when assessing the relative level of impacts of each alternative, these impacts should be evaluated relative to the probability of inundation, with emphasis on those zones subject to the greatest potential impact but with low probability of inundation (i.e., zones above 1,282.6 m [4,208 ft]).

- The relative impacts of the build alternatives change with changes in lake level. The amount of each habitat type remaining in the project study area at various inundation levels for each of the build alternatives is directly related to the actual distribution of different habitat types in the project study area and differences in the spatial alignments of each alternative.

- Upland and wetland/riparian habitats are more abundant at low lake levels than at high lake levels. With rising lake level, inundation combines with direct habitat loss that would result from the build alternatives to reduce the overall availability of habitat to wildlife. Because the portion of the highway footprint that is inundated would not be available whether or not the alternative were constructed, the direct loss of available habitat caused by the build alternatives is lowest at high lake levels and highest at low lake levels. (It should be noted that the highway itself would not be inundated because it would be raised above ground level.)

- The overall carrying capacity for wildlife species using these habitats could decrease proportionally with the decrease in resource availability as lake level rises.

- As lake level rises, the diminishing available habitat will be located progressively nearer to the alternative rights-of-way. This spatial relationship would likely increase the potential for wildlife impacts associated with the Proposed Action (e.g., noise, disturbance, highway mortality).

- The higher-elevation portions of the project study area provide important refuge habitats for many wetland species when lake levels are high. With increasing lake level, the relative impacts of the build alternatives on these refuge areas will increase (Table 4.13-9). However, large areas of the wildlife habitat that characterize the project study area are found throughout the GSLE. The wider availability of habitats makes the study area less important on a regional scale.

- The above-described effects of lake level change were determined for existing conditions. Projected future build-out within the project study area would result in a marked reduction in the amount of remaining natural habitat in the project study area (Table 4.13-5). Under the future build-out conditions, habitat will be located primarily west of the build alternatives. The combined effects of a rise in lake level, future build-out, and the proposed Legacy Parkway would leave little habitat available at high water for wildlife within the project study area. The overall habitat loss/fragmentation effects of the Proposed Action on the remaining small amount of natural habitat would be proportionally greater with future build-out.

- If increasing lake level occurs rapidly, some less mobile wildlife (e.g. mice, snakes, frogs, nonflying insects) will perish unless they can move to suitable habitat above the waterline. If the rise is gradual (e.g., over several seasons), local populations will change in size in proportion to the reduced carrying capacity of the remaining habitat.

- As the lake level recedes, the effects of inundation decrease as former habitat regenerates.

Table 4.13-8 Regional Wildlife Habitat Availability at Low and High Great Salt Lake Levels

Habitat	Alternative A				Alternative B			
	Area* (acres)	% of Regional Habitat at Low Lake Level	% of Regional Habitat at High Lake Level	Change in % Between High and Low Lake Level	Area* (acres)	% of Regional Habitat at Low Lake Level	% of Regional Habitat at High Lake Level	Change in % Between High and Low Lake Level
Pasture	318	0.11	0.11	0.00	351	0.12	0.12	0.00
Cropland	1	0.00	0.00	0.00	3	0.00	0.00	0.00
Scrub	270	0.13	0.13	0.00	283	0.14	0.14	0.00
Hydric Meadow	56	0.06	0.08	0.02	87	0.09	0.09	0.00
Sedge cattail	27	0.06	0.17	0.11	110	0.26	0.56	0.31
Mudflat/Pickleweed	3	0.00	0.00	0.00	12	0.01	0.00	0.00
Riparian	0	0.00	0.00	0.00	1	0.02	0.03	0.00

Habitat	Alternative C				Alternative E			
	Area* (acres)	% of Regional Habitat at Low Lake Level	% of Regional Habitat at High Lake Level	Change in % Between High and Low Lake Level	Area* (acres)	% of Regional Habitat at Low Lake Level	% of Regional Habitat at High Lake Level	Change in % Between High and Low Lake Level
Pasture	213	0.07	0.08	0.00	264	0.09	0.09	0.00
Cropland	1	0.00	0.00	0.00	1	0.00	0.00	0.00
Scrub	293	0.14	0.14	0.00	278	0.14	0.14	0.00
Hydric Meadow	70	0.07	0.08	0.01	61	0.06	0.09	0.03
Sedge cattail	86	0.20	0.39	0.19	45	0.11	0.29	0.18
Mudflat/Pickleweed	17	0.01	0.01	0.00	3	0.00	0.00	0.00
Riparian	0	0.01	0.00	-0.01	0	0.00	0.00	0.00

Note:

*Area represents acreage of each habitat within the build alternative right-of-way. These acreages are based on the regional dataset to facilitate regional-scale analysis.

Table 4.13-9 Wildlife Habitat Availability within the Project Study Area at Low and High Great Salt Lake Levels*

	Project Study Area			Alternative A				Alternative B			
Habitat	At Low Lake Level (acres)*	At High Lake Level (acres)	Change in Available Habitat (acres) Between Low and High Lake Level	Area (acres)	% of Project Study Area Habitat at Low Lake Level	% of Project Study Area Habitat at High Lake Level	Change in % Between High and Low Lake Level	Area (acres)	% of Project Study Area Habitat at Low Lake Level	% of Project Study Area Habitat at High Lake Level	Change in % Between High and Low Lake Level
Pasture	3,372	3,371	1	318	9.44	9.44	0.00	351.38	10.42	10.42	0.00
Cropland	83	81	1	1	0.81	0.82	0.01	3.11	3.77	3.83	0.05
Scrub	2,469	2,416	53	270	10.94	11.18	0.24	282.66	11.45	11.70	0.25
Hydric Meadow	1,203	888	315	56	4.70	6.36	1.67	87.40	7.27	9.84	2.58
Sedge cattail	1,212	541	671	27	2.22	4.98	2.76	110.09	9.08	20.36	11.28
Mudflat/Pickleweed	341	62	279	3	0.85	4.63	3.78	11.79	3.45	18.86	15.41
Riparian	8	6	2	0.00	0.00	0.00	0.00	0.89	11.76	15.38	3.62

	Alternative C				Alternative E			
	Area (acres)	% of Project Study Area Habitat at Low Lake Level	% of Project Study Area Habitat at High Lake Level	Change in % Between High and Low Lake Level	Area (acres)	% of Project Study Area Habitat at Low Lake Level	% of Project Study Area Habitat at High Lake Level	Change in % Between High and Low Lake Level
Pasture	213	6.31	6.31	0.00	263.54	7.82	7.82	0.00
Cropland	1	1.08	1.09	0.01	0.67	0.81	0.82	0.01
Scrub	293	11.86	12.12	0.26	278.44	11.28	11.52	0.25
Hydric Meadow	71	5.86	7.94	2.08	61.16	5.08	6.89	1.80
Sedge cattail	86	7.08	15.88	8.80	45.15	3.72	8.35	4.63
Mudflat/Pickleweed	17	4.95	27.05	22.10	2.89	0.85	4.63	3.78
Riparian	0	2.94	3.85	0.90	0.00	0.00	0.00	0.00

Note: * Acreages are derived from the regional GIS dataset, which is a low-resolution dataset; the acreages differ from those presented in project-level analyses.

4.13.3.3 Habitat Fragmentation

No-Build Alternative

Existing Conditions (2004)

The historic wildlife habitats of the GSLE along the Wasatch Front have been highly fragmented by urban, industrial, and agricultural development and numerous highways and roads. These land use changes have created a major barrier to movement by many species of wildlife from the Wasatch foothills to Great Salt Lake. However, under the existing conditions No-Build Alternative, there would be no project-related fragmentation of wildlife habitat in the project study area.

Future Conditions (2020)

As described in Section 4.13.3.1, regardless of whether the proposed action is implemented, future planned development is anticipated to occur throughout the project study area and vicinity, and this future development will be a source of future wildlife habitat fragmentation. This build-out of developable lands within the study area would result in additional loss and fragmentation of existing wildlife habitats from urban/industrial development and construction of associated roads. Under this scenario, most of the habitat changes would result from direct habitat loss as large blocks of existing habitat are converted to developed land. This would include most if not all of the developable wildlife habitat included in the proposed Legacy Nature Preserve (Figure 4.13-12). The roads associated with these developments would mostly be contained within these converted blocks, although some peripheral and connector roads would also likely be built. Many of the existing large habitat patches, as well as medium and small patches, would be lost, but it is not known to what extent these existing habitat patches would be fragmented into smaller patches.

Build Alternatives

All the build alternatives would dissect the matrix of wildlife habitats in the project study area into east and west areas. The area east of the proposed rights-of-way is largely modified by development and is experiencing continued rapid urban growth. Projected future growth in this area is likely to result in complete build-out. This area, however, does not appear to support any ecologically unique habitats that are not still represented west of the proposed alignments. The area west of the project rights-of-way retains a greater proportion of wetlands and wildlife habitats. This primary fragmentation effect of the project is not expected to reduce the diversity of habitat types within the project study area.

In addition to this primary fragmentation effect, all the build alternatives would result in the finer scale fragmentation of many existing wildlife habitat patches within the project study area. Each build alternative would result in a general decrease in the size of habitat patches available to wildlife in the area and a decrease in the number of larger patches, particularly in upland habitats. There would be a declining trend in the total amount of habitat in most size classes in most habitat types, with the exception of wetland habitats in the <0.4-ha (<1-ac) size class.

These changes would likely result in a number of effects on wildlife habitat, including reduction in habitat patch size, increase in the perimeter-to-area ratio of patches and associated edge effects, reduced connectivity between habitat patches, and introduction of barriers to dispersal for some species. Reduced habitat patch size can decrease the resources available to wildlife species, in turn reducing the local carrying capacity for those species. Moreover, smaller habitat patches are typically characterized by an increase in the length of the patch edge relative to the patch area, as well as a reduction in the distance

from the edge to the center of the patch. These changes can favor a reduction in the ecological buffering capacity of the patch for species sensitive to detrimental factors outside the patch (e.g., microclimate, competition from other species, predation, noise and human disturbance, pollution, and highway mortality). Construction of any build alternative could also introduce a physical barrier to movement and dispersal of some species. The wildlife species most affected by habitat fragmentation would be those with low dispersal capabilities, such as small mammals, reptiles, and amphibians (Forman et al. 2003). Birds would likely be less affected because they can generally move more readily between available habitat patches both within and outside of the project study area.

A quantitative assessment of the habitat fragmentation impacts for each alternative is provided in Table 4.13-10.

The overall effects of construction of the Legacy Parkway project on habitat fragmentation are summarized below.

- Alternatives A and E would have the least impact on fragmentation across the habitat types. Alternative A is located more to the east and would reduce the amount of habitat isolated between the right-of-way and existing development east of the alignment.

- The number of upland patches would increase under all build alternatives. Alternatives A and E would cause the least increase in the number of upland patches. Alternative B would cause the largest increase in the number of upland patches, predominantly in the smaller patch sizes. The changes in mean patch size reflect the same pattern.

- The number of wetland/riparian patches would increase under all build alternatives. Alternative E would cause the least increase in the number of wetland/riparian patches. Alternative A would cause the highest increase, but would result in very little change in mean patch size.

- In the area east of the proposed alignments, there are no unique or unusually valuable habitat types, either terrestrial or wetland/riparian, that would not still be represented in the remaining area west of the alignments. This primary fragmentation effect of the project would not therefore reduce the diversity of habitat types in the project study area or in the GSLE in general.

- The fragmentation effects of the build alternatives on local wildlife populations would be additive to existing levels of fragmentation and all reasonably foreseeable future fragmentation that is likely to occur in the area (see Section 4.13.3.3, *Cumulative Effects*). Physical segregation of upland habitats from wetlands in the project study area could potentially have an adverse regional effect on migratory shorebirds and waterfowl that traditionally use both habitats in the area.

Table 4.13-10 Summary of Habitat Fragmentation by Habitat Category Resulting from Build Alternatives

Habitat Category	Alternative		Number of Patches in Each Size Class					**Total Number of Patches**	Summary Statistics (acres)	
			<1	1–10	10–50	50–100	>100		Mean Patch Size	Median Patch Size
Upland	No Action		153	74	44	11	12	294	20.05	0.79
	Alternative A	Patches Fragmented	16	9	17	6	10	58		
		Total Patches	184	99	47	12	13	355	15.25	0.86
	Alternative B	Patches Fragmented	9	19	25	8	11	72		
		Total Patches	203	99	57	16	11	386	13.59	0.82
	Alternative C	Patches Fragmented	11	17	20	7	10	65		
		Total Patches	183	103	49	11	13	359	15.12	0.94
	Alternative E	Patches Fragmented	11	11	15	7	10	54		
		Total Patches	185	95	51	15	11	357	15.23	0.79
Wetland/ Riparian	No Action		470	226	39	6	2	743	3.21	0.59
	Alternative A	Patches Fragmented	41	58	9	1	1	110		
		Total Patches	502	215	36	6	2	761	2.99	0.47
	Alternative B	Patches Fragmented	80	77	16	3	2	178		
		Total Patches	505	206	40	7	1	759	2.91	0.48
	Alternative C	Patches Fragmented	73	73	14	2	1	163		
		Total Patches	504	209	35	8	1	757	2.94	0.45
	Alternative E	Patches Fragmented	60	64	9	1	1	135		
		Total Patches	499	214	36	6	2	757	2.99	0.45

Habitat Category	Alternative		Number of Patches in Each Size Class					**Total Number of Patches**	Summary Statistics (acres)	
			<1	1–10	10–50	50–100	>100		Mean Patch Size	Median Patch Size
Open Water	No Action		29	14	3	1	1	48	5.93	0.61
	Alternative A	Patches Fragmented	3	0	1	1	0	5		
		Total Patches	33	16	3	0	1	53	5.20	0.54
	Alternative B	Patches Fragmented	4	1	1	1	0	7		
		Total Patches	28	15	3	0	1	47	5.67	0.74
	Alternative C	Patches Fragmented	4	1	1	0	0	6		
		Total Patches	27	16	2	1	1	47	6.03	0.69
	Alternative E	Patches Fragmented	6	1	1	1	0	9		
		Total Patches	32	16	3	0	1	52	5.29	0.54

Because the existing habitat in the project study area is already highly fragmented by a diversity of human activities (e.g., agriculture, fences, roads, urban development), the additional fragmentation effects that the build alternatives would have on wildlife would likely be less than but additive to the effects of direct habitat loss. The fragmentation analysis of the build alternatives shows detectable variation among alternatives, but the differences are small and biologically indistinguishable at the scale of this analysis. The results of the assessment of the effects of direct habitat loss on species of concern indicate that while local populations of some species would be affected by loss of individuals and/or habitat, these losses alone would not result in a notable change in the long-term viability of these species in the GSLE. Similarly, because the existing condition of the project study area is highly fragmented as a result of past land use activities, the contributory effects of habitat fragmentation by the build alternatives would not likely result in any detectable change in long-term population viability of any species of concern in the area.

4.13.3.4 Air Quality

No-Build Alternative

Existing Conditions (2004)

Under the existing conditions No-Build Alternative, there would be no project-related air quality impacts that would affect wildlife habitat in the project study area.

Future Conditions (2020)

As described in Section 4.8, *Air Quality*, of this document, regardless of whether the proposed action is implemented, mobile source air emissions in the study area are projected to decrease significantly by 2020, and emissions differences between the build and no build alternatives would be minimal. Some emissions would slightly increase under the build alternatives compared to the No Build Alternative, and others would slightly decrease. Analysis of future (2020) air quality conditions indicates that CO and PM will likely be higher in the region under the no-build conditions. Ozone is not expected to cause new exceedances of the National Ambient Air Quality Standards (Utah Department of Environmental Quality, Division of Air Quality 1997), but the potential effects of ozone on wildlife in the study area are unknown. Similarly, future concentrations of nitrogen dioxide, sulfur dioxide, and lead are not expected to change from existing conditions in the region, but their effects on wildlife are unknown.

Build Alternatives

Any effects on wildlife and the quality of wildlife habitat resulting from changes in air quality would be similar under all build alternatives and, given the forecast levels of emissions, similar to the no-build condition.

Section 4.8, *Air Quality*, describes the existing and projected air quality conditions in the project study area. Any effect on wildlife habitat quality resulting from changes in air quality would be similar for all alternatives. Virtually nothing is known about how changes in air quality affect wildlife. Existing air quality standards established for human health provide a baseline standard for potential effects on wildlife. Temperature inversions and local concentrations of air pollutants would likely effect humans and wildlife comparably, although differences in physiology (e.g., higher metabolism and proportionally larger alveolar lung/air sac surface area in birds) may exacerbate some effects in some species. Animals are exposed to air pollutants through the inhalation of gases or small particles and the absorption of gases through the skin. Amphibians and soft-bodied invertebrates (e.g., earthworms) are most susceptible to be affected by the absorption of air pollutants. An individual's response to a pollutant varies greatly and

depends on the pollutant involved, the duration and time of exposure, and the amount taken up by the animal. Pollutant fallout onto vegetation and existing water bodies in the project study area could have local effects on plant productivity, ecotoxicity of plants used for food by wildlife, and water quality (see below). The overall potential effects of critiria air pollutants on resident humans and presumably wildlife populations would likely include the following, as described by pollutant.

- **Nitrogen dioxide.** Lung damage, illnesses of breathing passages and lungs. Nitrogen dioxide is an ingredient of acid rain, which can damage vegetation and water quality for amphibians, fish, and other aquatic organisms.

- **Volatile organic compounds (VOCs).** VOCs include chemicals such as benzene, toluene, methylene chloride, and methyl chloroform. They react with nitrous oxides (NO_x) to form ozone, which can cause breathing problems, reduce lung function, irritate eyes and respiratory passages, reduce resistance to infections, and possibly speed up aging of lung tissue. VOCs can also cause cancer, and ozone can damage vegetation.

- **Carbon monoxide.** Reduces the ability of blood to bring oxygen to body cells and tissues; it is particularly hazardous to individuals that have damaged lungs or breathing passages. Can exacerbate problems created by VOCs, NO_xs, and ozone.

- **Lead-containing dust.** Can cause brain and other nervous system damage. Small and young individuals are at special risk. Some lead-containing chemicals cause cancer in animals. Lead also causes digestive problems.

- **Particulate matter (PM).** Can cause respiratory passage irritation, lung damage, and bronchitis.

4.13.3.5 Water Quality

No-Build Alternative

Existing Conditions (2004)

Under the existing conditions No-Build Alternative, there would be no project-related impacts on water quality that would affect wildlife habitat in the project study area.

Future Conditions (2020)

If none of the build alternatives is implemented, proposed future development could affect water quality in the project study area. As described in Section 4.10.3.2, *Surface Water Quality*, if none of the build alternatives is implemented, future transportation improvement projects may be undertaken by local jurisdictions in the project study area. In addition, residential, commercial, and industrial development will continue in the project study area regardless of whether Legacy Parkway is constructed. These projects will increase the amount of impervious surface area, change runoff characteristics, and potentially degrade surface water quality, although the nature and timing of such future projects and the BMPs that will be used to minimize water quality impacts are not known at this time.

Build Alternatives

All the build alternatives would result in similar increases in highway runoff contaminants. Section 4.10, *Water Quality*, and the wildlife technical memorandum provide a list of the primary contaminants in the

project study area and their sources. The primary contaminants are not the only contaminants present in highway runoff, but they are the contaminants of primary concern regarding effects on water quality (Moellmer pers. comm.). The primary contaminants reduce water quality and potentially affect wildlife in a variety of ways (Forman et al. 2003). Because of the increased transportability of many of these contaminants in aquatic systems, wetlands adjacent to the highway would most likely be the areas most affected. However, the design of the Legacy Parkway project includes a vegetated median and side slopes, which would minimize exposure to the primary contaminants in wildlife habitats adjacent to the highway. Any adverse effects of these contaminants would be restricted to local concentration areas where these features are present.

Hazardous waste or other chemical spills in wetland habitats could potentially have catastrophic effects on wildlife, especially when lake levels are high. Existing UDOT and FHWA/EPA requirements for safe transport of these materials and emergency spill containment programs minimize these effects under most conditions, but unavoidable accidents do occur. In the State of Utah during the 10-year period from 1994 to 2003, an average of 215 highway incidents involving hazardous materials occurred per year, but only 6.7 of these incidents on average were considered serious each year.[4] Most effects of these incidents are generally localized and would consequently vary under different build alternatives, although they would likely be the worst in aquatic habitats. The Alternative B alignment, which crosses the most wetland habitat, would be most susceptible to adverse effects on wildlife resulting from an accidental hazardous materials spill. Because the Alternative A and Alternative E alignments are located in more upland areas, they would be somewhat less susceptible than the other alternatives.

Under all build alternatives, simultaneous development would occur in areas that are not preserved east of the highway. As described above for the no-build future conditions, the effects of these projects would add to those of the proposed action with regard to increases in the amount of impervious surface area, changed runoff characteristics, and associated degradation of surface water quality.

4.13.3.6 Wetland Hydrology

No-Build Alternative

Existing Conditions (2004)

Under the existing conditions No-Build Alternative, there would be no project-related impacts on wetland hydrology that would affect wildlife habitat in the project study area.

Future Conditions (2020)

If none of the build alternatives is implemented, future residential, commercial, and industrial development projects may be undertaken by local jurisdictions in the project study area. These projects will increase the amount of impervious surface area, changing surface water runoff characteristics and wetland hydrology. However, the nature and timing of such future projects, and their relative effect on wetland hydrology, are not known at this time.

[4] A serious incident is defined as a fatality or major injury caused by the release of a hazardous material, the evacuation of 25 or more persons as a result of release of a hazardous material or exposure to fire, a release or exposure to fire which results in the closure of a major transportation artery, the alteration of an aircraft flight plan or operation, the release of radioactive materials from Type B packaging, the release of more than 11.9 gallons or 88.2 pounds of a severe marine pollutant, or the release of a bulk quantity (more than 119 gallons or 882 pounds) of a hazardous material (http://hazmat.dot.gov/files/hazmat/hmisframe.htm).

Build Alternatives

In 2001, 1.5 to 1.8 m (5 to 6 ft) of fill was placed along the Alternative E alignment between I-215 and 1500 South, and up to 6 m (20 ft) was placed in the I-215 interchange area. To determine empirically how these activities would affect local wetland hydrology, a network of piezometers (soil water-pressure gauges) were installed parallel to the fill areas in 2001 (Forster and Neff 2002). The preliminary results of this study suggest that most water found in the shallow subsurface is likely derived from water discharging upward from underlying deeper aquifers, rather than from water contributed by direct precipitation. Thus, groundwater moving from deeper aquifers is the principal source of water supplying groundwater wetlands near and west of the proposed highway right-of-way (Forster and Neff 2002). Therefore, it is unlikely that the groundwater supply to those types of wetlands in the project study area would be seriously affected by highway construction. The proposed groundwater water conveyance structures (see Section 4.10, *Water Quality*) should yield a drainage system that removes barriers to surface water flows and adequately mimics the westward flow of shallow water beneath the right-of-way. Groundwater levels within the project right-of-way would be monitored during project construction to assess potential impacts on wetland hydrology.[5]

4.13.3.7 Wildlife Mortality

No-Build Alternative

Existing Conditions (2004)

Under the existing conditions No-Build Alternative, there would be no project-related wildlife mortality.

Future Conditions (2020)

If none of the build alternatives is implemented, proposed future development could occur such that wildlife mortality in the project study area could increase. As habitat is lost, local populations of wildlife species using that habitat will be lost either through direct mortality during development or indirectly as habitat quality changes. However, the nature, timing, and extent of these impacts would be project-specific and are not quantifiable at this time.

Build Alternatives

There may be some wildlife mortality during construction of the build alternatives, particularly for less mobile species such as amphibians and invertebrates. In addition, this Supplemental EIS addresses the issue of potential wildlife mortality from roadway operation. UDOT records of documented roadkill from roadway operations are nonspecific and generally represent only large mammals (e.g., deer), not smaller species. This information is of limited value in evaluating the full spectrum of species affected by road-related mortality.

With increased vehicular traffic in the project study area under all the build alternatives, road mortality of individuals of some species—particularly birds flying between habitat patches on different sides of the highway and dispersing amphibians, reptiles, and small mammals—is likely to increase. This would be

[5] The groundwater modeling conducted for the Final EIS indicates that the maximum decrease in groundwater elevation under any proposed build alternative would be less than 2.5 centimeters (1 inch) in areas where the fill would be up to 3 m (9 ft), which is where the majority of groundwater slope wetlands are located within the project right-of way.

particularly evident during periods of high lake level when waterfowl and shorebirds would be more likely to use upland habitats adjacent to the highway. The three fences proposed to border the highway right-of-way would help minimize these impacts by forcing some birds, particularly larger waterfowl, to take higher flight paths and/or deterring cross-highway movement of other species. Numerous drainage culverts proposed for installation under the highway could also facilitate wildlife movement without road mortality. The effects of highway-related road mortality of wildlife would likely be similar under all the build alternatives and would not likely affect the viability of any species in the project study area.

4.13.3.8 Artificial Landscaping

No-Build Alternative

Existing Conditions (2004)

Under the existing conditions No-Build Alternative, there would be no change in the extent of artificial landscaping in the project study area.

Future Conditions (2020)

If none of the build alternatives is implemented, proposed future residential, commercial, and industrial development could be undertaken in the project study area. These projects would likely remove existing natural vegetation and increase the amount of artificial landscaping in the area, removing habitat for some existing species, but replacing it with urban landscaping suitable for other species. The overall impacts would depend on the nature and extent of these changes and are not known at this time.

Build Alternatives

Artificial landscaping often attracts a diversity of species, particularly birds and small mammals (Forman et al. 2003). Migrating passerine birds frequently rest and forage on insects and fruit in landscaped areas. Fruit- and seed-producing trees and shrubs are especially attractive to these species. Planted trees also attract a variety of raptors, particularly hawks, falcons, and owls, which use them for night/day roosting and nesting sites. Raptors perch in these trees to hunt for rodents, rabbits, and other prey in adjacent fields. Some small mammals may also find suitable food and shelter in landscaped areas associated with highways (Forman et al. 2003).

According to the Landscape Baseline Plan in the Final EIS, the type and design of plantings in the artificial landscaping would be similar under all build alternatives. To minimize perching opportunities for raptor, no trees would be planted on the west side of the right-of-way, adjacent to the Legacy Nature Preserve. Trees planted east of the right-of-way, adjacent to the trail, as well as all other new landscaping, would be either native species or species that are not considered invasive.

The new landscaping would potentially have both beneficial and adverse effects on wildlife species that currently inhabit the project study area. These effects would be similar under all build alternatives. Beneficial effects would include the introduction of new trees, shrubs, and herbaceous vegetation that would provide foraging, roosting, and nesting habitats for birds and other wildlife. Adverse effects could potentially occur from the proximity of the vegetation to the highway (Forman et al. 2002). Wildlife mortality due to collisions with vehicles could potentially increase because a variety of species would be attracted to this roadside vegetation for cover and food (see Section 4.13.3.7, *Wildlife Mortality*, above). Resident owls, migrating raptors, passerine birds, and some mammals could find landscaped areas especially attractive. The artificial landscaping would also contribute to both the local and regional

cumulative effects on wildlife from all new urban landscaping, although UDOT has committed to using native vegetation for landscaping activities to the maximum extent possible.

4.13.3.9 Artificial Light Disturbance

No-Build Alternative

Existing Conditions (2004)

Under the existing conditions No-Build Alternative, there would be no project-related change in the amount of artificial lighting in the project study area.

Future Conditions (2020)

If none of the build alternatives is implemented, artificial lighting associated with future residential, commercial, and industrial development projects in the project study area would increase. However, the overall impacts on wildlife would depend on the nature and extent of artificial lighting that is installed, and the specific impacts cannot be quantified at this time.

Build Alternatives

All build alternatives would contribute minimally to the existing effects of artificial lighting on wildlife within the project and regional study areas. New artificial lighting associated with the proposed action would be associated with localized street lamps at on-ramps and off-ramps, luminaries (lighting of highway signs), headlights, and possibly the trail system. When the lake level is high, many migratory birds are likely to use the wetlands and uplands close to the highway. During periods of low visibility, the lights at intersections could attract migratory birds that become disoriented. Under such conditions, birds could collide with moving vehicles or light poles. While such bird mortality events have been documented in the Great Salt Lake Basin and elsewhere (Jones & Stokes 2005), adverse low-visibility weather is infrequent in the project study area.

Overall, the proposed action would add a minimal amount of light to existing conditions. Potential effects of light on birds, amphibians, mammals, fish, aquatic invertebrates, and terrestrial invertebrates also are likely to be minimal (Jones & Stokes 2005). Light associated with the Legacy Parkway trail system would be minimized by shielding the lights or directing them downward.

4.13.3.10 Noise Disturbance

No-Build Alternative

Existing Conditions (2004)

Under the existing conditions No-Build Alternative, there would be no project-related change in the level of noise disturbance in the project study area.

Future Conditions (2020)

If none of the build alternatives is constructed, future planned build-out of the project study area will still occur and will likely cause noise to rise above existing levels. Potential future growth scenarios that exclude the proposed action and related sources of noise disturbance are described in detail in the wildlife

technical memorandum. Typical noise levels for progressive phases of development are summarized below (Cowan 1994).

- Rural 40–48 decibels (dB)
- Small town and quiet suburban 45–55 dB
- Suburban and low-density urban 52–60 dB
- Urban area 58–67 dB
- Dense urban area with heavy traffic 65–74 dB
- Downtown in large city 72–80 dB

It is anticipated that under the future conditions No-Build Alternative, noise in the project study area will likely increase from that typical of the lower noise levels (rural) to typical of urban settings. However, as noted in 4.13.2.5 above, these increases would not be as dramatic in the portions of the project study area that currently experience high levels of noise. Noise sources would contribute to the future noise environment of the project study area in proportion to the temporal phasing and geographic extent of each type of development.

Build Alternatives

The modeled areal extent of potential highway noise effects on wildlife habitat is shown for each build alternative in Figures 4.13-13a and 4.13-13b). The total area of wildlife habitats exposed to the different noise levels (combined area of all habitat types within each noise level contour) within the area analyzed is summarized in Table 4.13-11. These estimates, however, are for reference comparison of alternatives only. This analysis studies potential indirect impacts beyond 305 m (1,000 ft), per the appellate court ruling; however, the noise level contours generated by the FHWA TNM have not been tested for accuracy beyond 396 m (1,300 ft). The locations of contours beyond this distance are projected estimates only and could vary significantly depending on existing background noise, atmospheric conditions, and substrate type. The noise levels shown within each contour interval, particularly those farthest from the proposed highway alignments, are likely to have only minimal, if any, effect on birds if background wind noise is prevalent (Jones & Stokes 2005).

Analysis of the total area of wildlife habitat that could be affected by highway noise in each noise contour interval showed an increase of between 42 percent and 61 percent in the 60+ dB impact area, depending on the alternative; an increase of between 19 percent and 58 percent in the 55 to 60 dB area; and an increase of between 27 percent and 47 percent in the 50 to 55 dB area. The noise level interval of 45 to 50 dB shows slight decreases in the area affected within the analysis area (Jones & Stokes 2005).

Table 4.13-11 Modeled Estimate of Wildlife Habitat Exposed to Noise under Build Alternatives

	Noise Level Interval (acres exposed to noise level[1])			
Alternative	>/= 60 dB	>/= 55 < 60 dB	>/= 50 < 55 dB	>/= 45 < 50 dB
No-Build (Existing Conditions)	6,908	5,632	8,438	26,551
Alternative A	10,501	7,848	10,726	25,333
Alternative B	11,124	8,884	12,462	25,582
Alternative C	9,814	8,041	11,669	25,298
Alternative E	10,670	6,686	11,985	25,057

Note:

[1] Noise levels measured as dBA.

Birds use vocal signals to communicate information on many aspects of their status and behavior that are important for survival, social cohesion, and reproductive success. Songs and calls function to identify the caller's species, sex, age (experienced adult vs. juvenile), territorial status, and motivational state (e.g., aggressive, submissive); to attract mates and repel rivals; to stimulate egg laying and synchronize hatching; to strengthen pair bonds; to signal change in domestic duties; to entice young to eat; and to warn of predators, maintain flock cohesion, and incite group mobbing action against intruders. Many species have complex vocal repertoires of songs and calls that can vary subtly in many ways, including frequency and timing of use, intensity (amplitude variation), and syntax (order of signal presentation). Clear transmission and reception of these signals and the subtleties of their variation are critical for maintaining the normal biological and ecological function of each species.

Highway noise typically is neither loud nor startling enough to cause marked stress effects on wildlife (Saigul-Klin et al. 1977). However, highway noise can mask important vocal communication and natural sounds important for mate attraction, social cohesion, predator avoidance, prey detection, navigation, and other basic behaviors. Masking of vocal communication occurs when highway noise interferes with signal transmission by swamping out the signal or parts of the signal (e.g., low-amplitude elements of a song) or degrading the signal to a point at which it is no longer recognizable to other members of a species. When such masking or degradation occurs, the normal communication and associated biological functions of the species can be impaired. Depending on the degree of masking and the particular species' capacity to adapt (e.g., to sing louder), masking can potentially result in abandonment of an area or reduced productivity and survival. Signal masking may result in the inability of males to effectively attract mates and/or repel territorial rivals. Excess energy may be required to physically maintain a territory and to sing louder. Predator warning and parent-offspring signals can be impaired. All these factors could potentially result in reduced survival and reproductive success of affected populations adjacent to the highway.

Traffic noise associated with all the build alternatives could potentially mask vocal communication among some birds. These masking effects are highly species-specific and depend largely on the unique bioacoustics characteristics of each species' vocal signals. The potential impact on American bitterns (*Botaurus lentiginosus*) represents the greatest distance for possible masking effects (4.8 km [3 mi]; see Appendix E of the wildlife technical memorandum), but this species is only a rare summer visitant to the GSLE that has not been observed in the project study area. Other species such as black-necked stilts (*Himantopus mexicanus*), which are common breeders within the project study area, would only be minimally affected by traffic noise close to the highway (76 m [250 ft]; see Appendix E of the wildlife technical memorandum). For territorial songbirds such as Brewer's sparrows (*Spizella breweri*), noise

would have a potential masking effect at intermediate distances. A detailed analysis of noise impacts on individual species is presented in the wildlife technical memorandum.

Potential Effects of Highway Noise on Species of Concern

Nine bird species of concern (bald eagle [*Haliaeetus leucocephalus*], Swainson's hawk [*Buteo swainsoni*], peregrine falcon [*Falco peregrinus*], prairie falcon [*Falco mexicanus*], burrowing owl [*Athene cunicularia*], short-eared owl [*Asio flammeus*], Wilson's phalarope [*Phalaropus tricolor*], bobolink [*Dolichonyx oryzivorus*], and American avocet [*Recurvirostra americana*]) are known to breed in or near the project study area.[6] The potential effects on these species of highway noise that would result from the build alternatives are described in detail in the wildlife technical memorandum. Based on a minimal vocal signal amplitude analysis, the potential effects distance of highway noise for bird species of concern could extend from less than 38 m (125 ft) to much more than 915 m (3,000 ft) from the highway depending on existing noise conditions. For example, for male bobolinks to transmit their complete territorial song they would have to be farther than 900 m (2,953 ft) from the highway, depending on existing noise conditions, to enable unmasked transmission of minimal signals in those songs. Similarly, Wilson's phalaropes would need to be more than 600 m (1,968 ft) from the highway, depending on existing noise conditions, to ensure that their low-amplitude vocal signals could be transmitted to neighboring nesting phalaropes. Burrowing owls would need to be 305 m (1000 ft) or more from the highway, depending on existing noise conditions, to avoid noise masking of inter-territorial communication.

It is not known exactly how highway noise would affect the local density and reproductive capacity of individual species of concern currently using habitats in the project study area. Highly noise-sensitive species may leave the affected areas; others may experience reduced reproductive success due to poor communication or reduced ability to detect predators and potential prey. Published research on highway noise impacts on grassland bird species in acoustic habitat (Reijnen et al. 1995) similar to that found in the project study area shows reduced bird densities in response to traffic noise levels higher than 45 dB(A). Using the modeled 45-dB(A) contour line as an outward-limit benchmark of effects, the area potentially affected by noise from the proposed action could extend on average 4 km (2.5 mi) from the highway (Jones & Stokes 2005).

4.13.3.11 Human Disturbance

No-Build Alternative

Existing Conditions (2004)

Under the existing conditions No-Build Alternative, there would be no project-related change in the level of human disturbance in the project study area.

Future Conditions (2020)

If none of the build alternatives is implemented, proposed future development could increase the level of human disturbance in the project study area. Although the nature and extent of such effects are not known at this time, it is likely that these impacts would be similar to those described for the build alternatives below given the increase in residential development planned for the study area.

[6] Table 4.13-1 above lists the special-status species known to occur or potentially occurring in the project study area. Section 4.15, *Threatened and Endangered Species*, further discusses impacts on species listed, proposed for listing, or candidates for listing, under the federal Endangered Species Act, and species listed on the Utah Sensitive Species List as wildlife species of concern.

Build Alternatives

Access of humans and domestic pets to wildlife habitats adjacent to the highway could result in some level of habitat degradation and wildlife mortality. The existing design for the Legacy Parkway project includes three fences that would restrict access to sensitive wildlife areas and should minimize these effects. Localized disturbance from human use of the proposed trail corridor is also possible, but such adverse effects would likely be secondary to traffic noise effects. Alternative B, which crosses the largest extent of wetland habitats (Figure 4.13-5), is the alternative where human disturbance would probably cause the greatest wildlife disturbance, particularly when the lake level is high. Because Alternatives A and E are located in more upland alignments than Alternatives B and C, human disturbance in these locations would probably disturb wildlife to a lesser extent. However, many wildlife species, particularly shorebirds, use these upland areas. Fencing of the highway right-of-way and protection of the Legacy Nature Preserve would reduce human impacts under all build alternatives.

4.13.3.12 Potential Effects on Species of Concern

As described in Section 4.13.2.3, *Existing Wildlife in Project Study Area*, several species analyzed in this section are protected under one or more federal or state wildlife protection law (e.g, the federal Endangered Species Act, the Migratory Bird Treaty Act, the Fish and Wildlife Conservation Act, Utah Administrative Rule R657-48). Table 4.13-2 summarizes the seasonal occurrence and abundance, migratory and breeding status, and habitat use patterns of these species within the GSLE and the project study area. This information is also described in more detail in the wildlife technical memorandum.

No-Build Alternative

Existing Conditions

Under the existing conditions No-Build Alternative, there would be no project-related impacts on special-status species. Habitat use and seasonal occurrence of special-status species in the study area would remain similar to that represented in Table 4.13-2.

Future Conditions (2020)

As described in Section 4.13.3.1, even without construction of Legacy Parkway, reasonably foreseeable future land use changes would add to the historic loss of wildlife habitat. Table 4.13-5 illustrates the potential impact of future development on wetland/wildlife habitat, both with and without the proposed build alternatives. Future losses of wildlife habitat would likely adversely affect special-status species in the study area, although the relative extent is not known.

Build Alternatives

The principal potential effects on wildlife species of concern would be similar under all the build alternatives (Jones & Stokes 2005); specific impacts on such species are addressed in Sections 4.13.1 through 4.13.11 above. These effects could include direct loss of foraging habitat, disturbance of nesting sites, and masking of vocal communication near the highway. The magnitude of these effects would be proportional to the level that individual species use each habitat. The project could result in a reduction in population of some species of concern within the project study area, but the overall impact of these losses alone would not affect the long-term viability of any of these species in the GSLE.

The following discussion provides information on how the proposed action could affect habitats for species of concern, based on input received from USFWS, EPA, and UDWR. The information presented below and correspondence from USFWS reaffirms the terms and conditions in the original biological opinion (BO), formal Section 7 consultation under the federal Endangered Species Act (ESA) for the Legacy Parkway project (see letter dated December 3, 2003, in Appendix A). Projected losses of individual habitats under each build alternative are presented in Table 4.13-6. These effects are summarized below; more detailed analyses are presented in the wildlife technical memorandum. Effects on species listed, proposed for listing, or candidates for listing under the federal ESA and wildlife species of special concern on the Utah Sensitive Species List are further discussed in Section 4.15, *Threatened and Endangered Species*.

Federally Listed Species

Bald Eagle (Status: Threatened)

Breeding. One active nest exists in an artificial nesting structure on state-owned land (i.e., the proposed Legacy Nature Preserve) within about 1.6 km (1 mi) of the project study area. UDOT constructed the artificial nesting structure after the tree that the nesting pair had previously occupied was blown down. This is the only known nesting location in northern Utah, and one of only four known in the state (Utah Division of Wildlife Resources 2002). This nest is within about 1 km (0.6 mi) of a regularly traveled country road, and the nesting pair is accustomed to some degree of human noise and disturbance (U.S. Fish and Wildlife Service 1999a). If this nest is active in the future, the pair could experience some noise disturbance from construction and operation of the Legacy Parkway project. Such disturbance could result in temporary or permanent abandonment of the site by the nesting eagles, resulting in a loss of productivity of up to two eggs or young per year during the construction period, and possibly during operation (if the nest site is abandoned permanently) (U.S. Fish and Wildlife Service 1999a). However, many raptor species nest in close proximity to highways, and they appear to habituate to highway noise. The actual effects of highway noise on this nesting pair cannot be determined without onsite analysis, but the effects are expected to be similar under all build alternatives. The USFWS biological opinion for the proposed action concludes that seasonal restrictions on construction would protect the nesting pair of bald eagles. See Table 4.15-3 for a complete listing of the terms and conditions of the USFWS biological opinion specific to bald eagle.

Raptors are often killed as a result of collisions with moving vehicles. Bald eagles often forage on carrion, and they may be attracted to highway corridors to forage on carcasses of mule deer and other large mammals and birds. The Legacy Parkway project could provide an additional source of carrion and could increase the potential for bald eagle collisions with vehicles, especially for inexperienced juvenile birds. Raptor mortality along roadways in Utah is not well documented, but 15 eagles were reported killed in Carbon and Emery Counties in 1996 and 1997, probably due to collisions with coal trucks (U.S. Fish and Wildlife Service 1999a). Direct mortality effects on bald eagles would likely be the same under all build alternatives.

Wintering. Bald eagles are common winter visitors to the project study area. Four active roost sites exist at distances of 2.3 km (1.4 mi), 2.1 km (1.3 mi), 1.6 km (1.0 mi), and 0.2 km (0.1 mi) from the project study area boundary. Some of these roost sites could be disturbed or abandoned during construction of any build alternative. The roost sites within 1 km (0.6 mi) of the project study area would be the most likely to be adversely affected (U.S. Fish and Wildlife Service 1999a).

In the project study area, bald eagles primarily forage in the following habitats: sedge cattail, hydric meadow, mudflat/pickleweed, pasture, and salt desert scrub. All the build alternatives would result in direct loss and fragmentation of suitable bald eagle foraging habitat. Alternative A would result in 184.6

ha (456.2 ac) of habitat loss; Alternative B in 235.7 ha (582.4 ac); Alternative C in 207.1 ha (511.8 ac); and Alternative E in 190.8 ha (471.5 ac). These direct habitat losses would contribute to the cumulative reduction of foraging habitat for this species in the project study area. However, according to the regional land use dataset analysis (Table 4.13-6), these losses would affect less than 0.11 percent of the overall extent of these habitats in the regional study area.

Federally Delisted Species

Peregrine Falcon

Breeding. Two nesting eyries exist in the project study area in abandoned Common Raven nests on 345 kV electric power transmission support towers; the same nesting pair uses both nests (U.S. Fish and Wildlife Service 1999a). This nesting pair is accustomed to some disturbance because their eyries are within 1.6 km (1 mi) of I-15 and within 0.2 km (0.1 mi) of a dike that supports a well-traveled, unsurfaced road in the FBWMA (U.S. Fish and Wildlife Service 1999a).

Raptors may be killed by collisions with moving vehicles. Peregrine falcons may forage for bird prey along highway corridors. The overall proximity of the Legacy Parkway project to the existing eyries increases the potential for peregrine falcon collisions with vehicles, especially for inexperienced juvenile birds (U.S. Fish and Wildlife Service 1999a). Direct mortality effects on peregrine falcons would probably be the same under all build alternatives. See Table 4.15-3 for a complete listing of the terms and conditions of the USFWS biological opinion specific to peregrine falcon.

Wintering. In winter, peregrine falcons from northern breeding populations are rare transients in the GSLE (U.S. Fish and Wildlife Service 1999a). They primarily forage in the following habitats in the project study area: sedge cattail, hydric meadow, mudflat/pickleweed, pasture, salt desert scrub, and developed areas. All build alternatives would result in direct loss and fragmentation of suitable wetland and upland peregrine falcon foraging habitat at the same levels as those described above for bald eagle.

Wintering peregrine falcons forage over large areas and are not dependent on individual habitat patches that may be lost during highway construction. Regional growth projected to occur is likely to lead to further loss and fragmentation of existing peregrine falcon foraging areas. Direct impacts of the Legacy Parkway project would affect less than 0.26 percent of any of these habitats in the regional study area (Table 4.13-6). These losses would contribute to the overall cumulative reduction of suitable foraging habitat for this species in this area.

Federal Candidate Species

Yellow-Billed Cuckoo

Yellow-billed cuckoos (*Coccyzus americanus*) are rare migrants in the GSLE; they have low potential to occur in the project study area because of limited suitable riparian breeding habitat (Table 4.13-2). Bird surveys conducted between 1999 and 2003 within the area of the proposed Legacy Nature Preserve concluded that yellow-billed cuckoos are rare migrants in the regional study area (Utah Department of Transportation 2004).). Recent documentation of a yellow-billed cuckoo in a peregrine falcon nest in Salt Lake City, however, suggests that this species still migrates through the GSLE and all remnant riparian habitats, including those available in the project study area, could potentially provide suitable roosting and foraging habitat for yellow-billed cuckoos. All build alternatives would result in direct loss of less than 2.3 ha (5.6 ac) of riparian habitat (Figure 4.13-6). Howe (1986 in Hughes 1999) reported densities of yellow-billed cuckoo in appropriate habitat in New Mexico ranging from 1 to 15 pairs per ha (0.4 to 6.1 pairs per acre). In suitable habitat, the area lost to construction of the proposed action could potentially support one to several pairs of yellow-billed cuckoos. However, the riparian habitats in the project study

area, which include areas of sparsely distributed Russian olive trees (*Elaeagnus angustifolius*), is generally degraded and of low suitability for this species. As indicated by the low number of birds detected in regional surveys mentioned above, the affected area is not likely to provide good habitat for this species. The habitat losses caused by the proposed action are unlikely to have any adverse effects on this rare transient species.

Conservation Agreement Species

Northern Goshawk

Northern goshawks (*Accipiter gentilis)* have not been observed in the project study area. However, some studies on the seasonal movement and habitat use patterns suggest that goshawks could potentially use the project study area during the winter. Moreover, the project study area supports prey species that could sustain wintering individuals that move through the GSLE. The few wintering individuals that may occur in this region probably range over a large area with a variety of grassland and shrubland habitats. Direct habitat loss under any build alternative would not likely affect this species.

U.S. Fish and Wildlife Service Birds of Conservation Concern

Swainson's Hawk

Swainson's hawks are considered rare summer breeders in the project study area, where they have been known to nest in riparian habitat. They have been observed in the areas delineated by the proposed Legacy Parkway rights-of-way. Favorable foraging conditions are common in the agricultural areas (primarily alfalfa) in and adjacent to the project study area; other crops, such as sod, corn, and wheat, also provide foraging habitat. Alternatives A and E would result in direct loss of 1.6 ha (3.9 ac) of riparian habitat, Alternative B in the loss of 2.3 ha (5.6 ac), and Alternative C in the loss of 2.0 ha (4.9 ac) (Figure 4.13-6).

Reported nesting densities for Swainson's hawks in areas with either a mixture of native habitat and agriculture or a high diversity of irrigated crops include 30.23 pairs/100 km^2 (0.001 pair/ac) in central California (England et al. 1995 in England et al. 1997); 23.1 pairs/100 km^2 (0.0009 pairs/ac) in Hanna, Alberta (Schmutz 1987); 18.0 pairs/100 km^2 (0.0007 pairs/ac) in Kindersley, Saskatchewan (Houston in England et al. 1997); and 9.5 pairs/100 km^2 (0.0003 pairs/ac) in Los Medanos, New Mexico (Bednarz et al. 1990). In northeastern California, the overall density of Swainson's hawk territories was 20 pairs/100 km^2 (0.0008 pairs/acre), but varied from 5.7 pairs/100 km^2 (0.0002 pairs/ac) in irrigated pasture to 36.8 pairs/100 km^2 (0.0014 pairs/ac) in areas dominated by alfalfa (Woodbridge et al. 1995a in England et al. 1997). These data indicate that the riparian area that would be lost under any build alternative would support at most only one pair of Swainson's hawk. Site-specific surveys would be necessary prior to construction to determine if any active Swainson's hawk nest is present within the project study area and whether any build alternative would disturb that nest.

All the build alternatives would also result in a direct loss of foraging habitat for this species. Alternative A would result in 57.3 ha (141.7 ac) of cropland habitat loss; Alternative B in 100.1 ha (247.3 ac]); Alternative C in 47.7 ha (117.8 ac); and Alternative E in 52.3 ha (129.3 ac). Based on radiotelemetry survey data in central California, Swainson's hawks forage over areas ranging between 325 ha (800 ac) and 8,500 ha (21,000 ac) (approx. average 2,750 ha [6,800 ac]; Estep pers. comm.). The foraging area that would be lost under each build alternative would comprise approximately 0.2 to 31 percent of the foraging range of a single pair, depending on the available habitat in the project study area. Loss of this habitat would result in that pair shifting to new foraging areas in the GSLE. The Legacy Parkway project

would affect less than 0.1 percent of the overall extent of these habitats in the regional study area (Table 4.13-6).

Ferruginous Hawk

Ferruginous hawks (*Buteo regalis)* have not been observed in the project study area but could potentially occur there while moving in or through the GSLE. Suitable habitats in the project study area include hydric meadow, mudflat/pickleweed, pasture cropland, and salt desert scrub. Ferruginous hawks could possibly occur in the same habitats as Swainson's hawks and would experience similar loss of foraging habitat under all the build alternatives. Although the direct impacts of the Legacy Parkway project would affect less than 0.1 percent of the overall extent of these habitats in the regional study area (Table 4.13-6), they would contribute to the local and regional cumulative reduction of suitable foraging habitat for this species.

Golden Eagle

Golden eagles (*Aquila chrysaetos*) are rare permanent residents of the GSLE and rare transients in the project study area. Their preferred foraging habitats in the GSLE could include hydric meadow, pasture, cropland, and salt desert scrub habitats. All the build alternatives would result in the direct loss of foraging habitat that could potentially be used by this species. Alternative A would result in 224.9 ha (555.8 ac) of habitat loss; Alternative B in 303.6 ha (750.1 ac); Alternative C in 228.4 ha (564.4 ac); and Alternative E in 216.0 ha (533.9 ac). In the western United States, golden eagles forage over home ranges that average 20 to 33 km^2 (2,000 to 3,300 ha [4,942 to 8,154 ac]) (Kochert et al. 2002). Resident pairs tend to maintain home ranges year-round, with shifts in intensity of use from breeding season to winter (Dunstan et al. 1978 in Kochert et al. 2002; Marzluff et al. 1997 in Kochert et al. 2002). Individuals do not use all areas within their home range equally, but concentrate activity within core areas (Platt 1984 in Kochert et al. 2002; Marzluff et al. 1997 in Kochert et al. 2002). In southwestern Idaho, core area contained 95 percent of locations of radio-tagged eagles, but only 14.4 percent of the breeding-season range and 25.3 percent of the non-breeding range (Marzluff et al. 1997 in Kochert et al. 2002). The low frequency of golden eagle occurrences in the project study area suggests that the birds that use this area are either residents with core territory areas elsewhere in the GSLE or are migrants moving through the area. The direct impacts of the Legacy Parkway project could affect 7.0 to 15.2 percent of one golden eagle home range, depending on its actual size, or small portions of several territories if they overlap. These impacts would affect less than 0.1 percent of the overall extent of these habitats in the regional study area (Table 4.13-6). The proposed action would not affect the long-term viability of this species within the GSLE but would contribute to the ongoing local and regional cumulative reduction of suitable foraging habitat for this species.

Prairie Falcon

Prairie falcons are rare permanent residents and breeders in the GSLE. They are occasionally seen foraging in the project study area, but they do not breed there (Table 4.13-1). Habitats most likely to be used by this species in the project study area are sedge cattail, hydric meadow, mudflat/pickleweed, pasture, cropland, and salt desert scrub. All the build alternatives would result in the direct loss of foraging habitat that could potentially be used by this species. Alternative A would result in 236.6 ha (584.6 ac) of habitat loss; Alternative B in 331.0 ha (817.9 ac); Alternative C in 249.4 ha (616.4 ac); and Alternative E in 232.5 ha (574.4 ac). The estimated home range of this species in southwestern Idaho is 108 to 315 km^2 (10,800 to 31,500 ha [26,690 to 77,840 ac]) (Dunstan et al. 1978 in Kochert et al. 2002; Marzluff et al. 1997 in Kochert et al. 2002). The direct impacts of the Legacy Parkway project could affect 0.7 to 3.1 percent of one prairie falcon home range, depending on its actual size and overlap with the project study area. For any alternative, this area would comprise less than 0.1 percent of the overall extent of these habitats in the regional study area (Table 4.13-6). The proposed action would not affect the

long-term viability of this species within the GSLE, but would contribute to the ongoing local and regional cumulative reduction of suitable foraging habitat for this species.

American Golden-Plover

American golden-plovers (*Pluvialis dominica*) are rare migrants through the GSLE and have not been observed in the project study area (Table 4.13-1). However, they could occur in the project study area during migration, where they may occasionally forage in pasture, cropland, mudflat/pickleweed, and hydric meadow habitats. All the build alternatives would result in direct loss of foraging habitats that could potentially be used by this species. Alternative A would result in 174.5 ha (431.2 ac) of habitat loss; Alternative B in 278.9 ha (689.2 ac); Alternative C in 179.6 ha (443.9 ac); and Alternative E in 171.2 ha (422.9 ac). The direct impacts of the Legacy Parkway project would affect less than 0.1 percent of the overall extent of these habitats in the regional study area (Table 4.13-6), but they would contribute to the local and regional cumulative reduction of suitable foraging habitat for this species.

Snowy Plover

Snowy plovers (*Charadrius alexandrinus*) are common breeders in the GSLE, but they have not been observed in the project study area (Table 4.13-1). Their preferred breeding and foraging habitats (salt flats and mudflat/pickleweed habitats) are minor components of the project study area. Because salt flats are relatively abundant in the GSLE, the local snowy plover population is unlikely to be adversely affected by the loss of 2.5 to 12.9 ha (6.2 to 32.0 ac) of mudflat/pickleweed habitat. The direct impacts of the Legacy Parkway project would affect less than 0.1 percent of the overall extent of these habitats in the regional study area (Table 4.13-6), but they would contribute to the local and regional cumulative reduction of suitable foraging habitat for this species.

American Avocet

American avocets occur regularly in the project study area (Table 4.13-1). In the project study area avocets nest in sedge cattail, hydric meadow, mudflat/pickleweed, and pasture habitats. Avocets forage in these habitats as well as in open water.. All the build alternatives would result in the direct loss of foraging habitats for this species. Alternative A would result in 130.0 ha (321.2 ac) of foraging habitat loss; Alternative B in 206.1 ha (509.3 ac); Alternative C in 140.6 ha (347.5 ac); and Alternative E in 132.6 ha (327.6 ac). The breeding density of American avocets in northern Utah has been estimated to be 16–28 pairs/ha (6–11 pairs/ac). If all the habitat area lost from construction of the proposed action were suitable for nesting (not including open water), Alternative A would result in the direct loss of nesting habitat for 1,828–3,433 pairs; Alternative B in the loss of habitat for 2,947–5,402 pairs, Alternative C in the loss of habitat for 2,077–3,807 pairs, and Alternative E in the loss of habitat for 1,908–3,498 pairs. However, because of the extensive distribution of suitable breeding habitat throughout the GSLE, the direct impacts of the Legacy Parkway project would affect less than 0.1 percent of the overall extent of these habitats (Table 4.13-6). Assuming the available habitat was used by avocets at the density described above, the maximum loss of breeding habitat from any alternative (i.e., habitat for 1,828–5,402 pairs for Alternatives A and B, respectively) would affect only approximately 3.4 to 10.2 percent of the estimated 53,000 breeding American avocets in the regional study area (Paul et al. 1998b in Robinson et al. 1997). The loss of habitat resulting from any build alternative would reduce the local density of breeding birds within the project study area but would not notably affect the long-term viability of American avocets in the GSLE. The project would, however, contribute to the ongoing marked cumulative loss of breeding habitat for this species throughout the region.

Solitary Sandpiper

Solitary sandpipers (*Tringa solitaria*) have not been observed in the project study area (Table 4.13-1). Patton et al. (1992 in Moskoff 1995) reported only 19 records of this species visiting Great Salt Lake; Point Reyes Bird Observatory (1995 in Moskoff 1995) recorded only three occurrences during fall migration in 1994 and 1995. Although they are unlikely to occur in the project study area in any given year, individuals may occasionally forage in emergent wetlands, shallow streams, and pools within riparian corridors, mudflat/pickleweed, and hydric meadow habitats. All the build alternatives would result in the direct loss of foraging habitats that could potentially be used by this species. Alternative A would result in 42.9 ha (106.0 ac) of habitat loss; Alternative B in 71.4 ha (176.4 ac); Alternative C in 62.8 ha (155.1 ac); and Alternative E in 48.5 ha (119.9 ac). The direct impacts of the Legacy Parkway project would affect less than 0.1 percent of the overall extent of these habitats in the regional study area (Table 4.13-6). Because of the low frequency of use of the project study area by solitary sandpipers, it is unlikely that loss of foraging habitat resulting from any build alternative would affect the long-term viability of this species in the GSLE, but such loss would contribute to the local and regional cumulative reduction of suitable foraging habitat for this species.

Whimbrel

Whimbrels (*Numenius phaeopus*) are rare transients in the GSLE and have not been observed in the project study area (Table 4.13-1). Although they are unlikely to occur in the project study area in any given year, individuals may occasionally forage in pasture, cropland, mudflat/pickleweed, and hydric meadow habitats. All the build alternatives would result in the direct loss of foraging habitats that could potentially be used by this species. Alternative A would result in 174.5 ha (431.2 ac) of habitat loss; Alternative B in 278.9 ha (689.2 ac); Alternative C in 179.6 ha (443.9 ac); and Alternative E in 171.2 ha (422.9 ac). The direct impacts of the Legacy Parkway project would affect less than 0.1 percent of the overall extent of these habitats in the regional study area (Table 4.13-6). Because of the low frequency of use of the project study area by whimbrels, it is unlikely that loss of foraging habitat resulting from any build alternative would affect the long-term viability of this species in the GSLE, but such loss would contribute to the ongoing local and regional cumulative reduction of foraging habitat for this species.

Long-Billed Curlew

Although breeding long-billed curlews (*Numenius americanus*) have not been observed in the project study area, occurrences of migrants have been documented (Table 4.13-1). They may forage in hydric meadows, mudflat/pickleweed, and areas within salt desert scrub habitat. All the build alternatives would result in the direct loss of breeding and foraging habitats that could potentially be used by species. Alternative A would result in 85.1 ha (210.4 ac) of habitat loss; Alternative B in 81.4 ha (201.2 ac); and Alternative C in 114.4 ha (282.6 ac); and Alternative E in 88.7 ha (219.1 ac). The direct impacts of the Legacy Parkway project would affect less than 0.1 percent of the overall extent of these habitats in the regional study area (Table 4.13-6). As with other transient shorebirds that use the project study area, it is unlikely that loss of foraging habitat resulting from any build alternative would affect the long-term viability of long-billed curlews in the GSLE, but such loss would contribute to the ongoing local and regional cumulative reduction of foraging habitat for this species.

Marbled Godwit

Marbled godwits (*Limosa fedoa*) are rare migrants in the project study area (Table 4.13-1). They forage in mudflat/pickleweed, shallow open water, cropland, pasture, and hydric meadow habitats. All the build alternatives would result in the direct loss of foraging habitats that could potentially be used by this species. Alternative A would result in 178.2 ha (440.3 ac) of habitat loss; Alternative B in 286.3 ha (707.4 ac); Alternative C in 180.2 ha (445.3 ac); and Alternative E in 175.1 ha (432.6 ac). The habitat losses

associated with all alternatives, however, would affect less than 0.1 percent of the overall extent of these habitats in the regional study area (Table 4.13-6). This change would result in local loss of foraging habitat for this species in the project study area; it would not affect the long-term viability of this species in the GSLE, but it would contribute to the ongoing regional cumulative reduction of suitable foraging habitat for this species.

Sanderling

Sanderlings (*Calidris alba*) have not been observed in the project study area (Table 4.13-1), but could occasionally use the area. Because their foraging habitat (mudflat/pickleweed) is a minor component of the project study area and this habitat is relatively abundant in the regional study area, sanderlings are unlikely to be adversely affected by the loss of 2.5 to 12.9 ha (6.2 to 32.0 ac) of habitat. The direct impacts of the Legacy Parkway project would affect less than 0.1 percent of the overall extent of these habitats in the regional study area (Table 4.13-6), but they would contribute to the local and regional cumulative reduction of suitable foraging habitat for this species.

Wilson's Phalarope

Wilson's phalaropes are rare breeders and uncommon migrants in the project study area (Table 4.13-1). They nest in hydric meadow habitat and forage there and in open water, sedge cattail, and mudflat/pickleweed habitats. All the build alternatives would result in the direct loss of breeding and foraging habitats that could potentially be used by this species. Alternative A would result in loss of 29.7 ha (73.3 ac) of breeding habitat loss; Alternative B in 41.7 ha (103.0 ac); Alternative C in 39.7 ha (98.1 ac); and Alternative E in 30.6 ha (75.6 ac). Very little information is available on nesting densities of this species. Estimated nest densities in an ephemeral wetland in Saskatchewan varied between 0 and 1.1 breeding pairs/ha (0.445 pairs/ac) and between 0.55 and 1.1 pairs/ha (0.22 and 0.44 pairs/ac) in a permanent wetland (Colwell and Jehl 1994). Assuming that hydric meadow habitat in the project study area is wet during the breeding season, Alternative A would result in potential loss of habitat for 16.3 to 32.7 pairs; Alternative B in the loss of habitat for 22.9 to 45.9 pairs; Alternative C in the loss of habitat for 21.8 to 43.7 pairs; and Alternative E in the loss of habitat for 16.8 to 33.7 pairs. The impact of the proposed action on the regional population of Wilson's phalaropes within the GSLE, however, would be small. In July, the Wilson's phalarope staging population at Great Salt Lake frequently comprises more than a third of the world's population, varying between 54,000 (1984) and 603,333 (1991) individuals (Aldrich and Paul 2002). A large number of these birds breed in the regional study area. On a regional scale, the hydric meadow habitat in the project study area comprises only 0.052 to 0.88 percent of the potential breeding habitat available to Wilson's phalaropes within the regional study area (Table 4.13-6).

Alternative A would result in 45.0 ha (111.2 ac) of foraging habitat loss; Alternative B in 76.5 ha (189.0 ac); Alternative C in 61.3 ha (151.6 ac); and Alternative E in 50.9 ha (125.8 ac). Because Wilson's phalaropes are highly gregarious and social throughout the year, they often concentrate in large numbers while foraging. These foraging habitat losses would likely result in shifts of foraging areas for local populations of birds using the project study area, which would contribute to the marked cumulative reduction of suitable foraging habitat. However, on a regional level, the direct impacts of the Legacy Parkway project would affect less than 0.1 percent of the overall extent of Wilson phalarope foraging habitats in the regional study area (Table 4.13-6).

Burrowing Owl

Burrowing owls have been observed in the project study area (Table 4.13-1), where suitable habitats include dry mudflat/pickleweed, pasture, cropland, salt desert scrub, urban fields, and freeway right-of-way. They nest in crevices and burrows, especially those excavated by red fox and badgers. They breed and forage primarily in pasture, salt desert scrub, and cropland (along edges) habitats as well as on dikes

and islands in water impoundments. All the build alternatives would result in the direct loss of breeding and foraging habitats for this species. Alternative A would result in 195.3 ha (482.5 ac) of habitat loss; Alternative B in 261.9 ha (647.1 ac); Alternative C in 188.7 ha (466.2 ac); and Alternative E in 185.5 ha (458.3 ac). Radiotelemetry studies of burrowing owl movement patterns in central Saskatchewan showed that home range size varied from 0.14 to 4.81 km^2 (14 to 48.1 ha [34.6 to 118.9 ac]). Assuming similar spatial requirements for burrowing owls in the regional study area, Alternative A would remove habitat sufficient to support 3.6 to 13.9 pairs, Alternative B would remove habitat for 5.4 to 18.7 pairs, Alternative C would remove habitat for 3.9 to 13.5 pairs, and Alternative E would remove habitat for 3.8–13.2 pairs. The population size of burrowing owls in the regional study area is unknown, but the direct impacts of the Legacy Parkway project would affect less than 0.1 percent of the overall extent of suitable habitats in the regional study area (Table 4.13-6). Such losses would contribute to a cumulative reduction of suitable foraging habitat for this species in the area.

This species is generally declining in many areas throughout the western U.S. (Haug et al. 1993). Vehicle collision is a major source of mortality. If the proposed action were to traverse existing burrowing owl habitat, road mortality would likely increase. Moreover, highway alignments can provide travel corridors for a variety of native and nonnative predators, including introduced foxes, which can have severe local effects on burrowing owl populations.

Loggerhead Shrike

Loggerhead shrikes (*Lanius ludovicianus*) are uncommon year-round residents in the GSLE and have not been observed in the project study area (Table 4.13-1). Suitable natural habitats in the project study area include riparian corridors, pasture, and salt desert scrub. All the build alternatives would result in the direct loss of breeding and foraging habitats that could potentially be used by this species. Alternative A would result in 139.5 ha (344.7 ac) of habitat loss; Alternative B in 164.1 ha (405.4 ac); Alternative C in 143.0 ha (353.4 ac); and Alternative E in 134.7 ha (332.8 ac). Reported territory sizes of loggerhead shrikes vary from 4.6 to 25 ha (10.4 to 62 ac) (Yosef 1996). Assuming comparable territory sizes in the regional study area, Alternative A would remove habitat sufficient to support 1 to 28 territories; Alternative B would remove habitat for 6.6 to 35.7 territories, Alternative C would remove habitat for 5.7 to 31 territories, and Alternative E would remove habitat for 5.4 to 29.3 territories. The direct impacts of the Legacy Parkway project would affect less than 0.1 percent of the overall extent of these habitats in the regional study area (Table 4.13-6) and would not affect the long-term viability of this species in the GSLE. However, such impacts would contribute to the marked ongoing cumulative reduction of suitable foraging habitat for this species.

Virginia's Warbler

Virginia's warblers (*Vermivora virginiae*) have not been observed in the project study area (Table 4.13 1). They are found during migration in riparian and some scrub (with large, tall shrubs) habitats that have high densities of insects. Potential habitat in the project study area includes riparian corridors, salt desert scrub, and urban shrub (developed). Virginia's warblers have low potential to occur in the project study area because of the limited extent of riparian habitat and the low stature of the shrubs in the salt desert scrub habitat (Table 4.13-1). All the build alternatives would result in direct losses of less than 2.3 ha (5.6 ac) of suitable habitat; these losses are unlikely to have any adverse effects on this species.

Brewer's Sparrow

Brewer's sparrows are rare summer visitants in the project study area (Table 4.13-1). They breed in shrub steppe habitats and are found during migration in riparian and scrub habitats. Suitable habitats within the project study area include riparian, hydric meadow, mudflat/pickleweed, pasture, cropland, salt desert scrub, and urban shrub (developed). All the build alternatives would result in the direct loss of breeding

and foraging habitats that could potentially be used by this species. Alternative A would result in 229.0 ha (565.9 ac) of habitat loss; Alternative B in 313.3 ha (774.3 ac); Alternative C in 243.3 ha (601.3 ac); and Alternative E in 224.2 ha (553.9 ac). Breeding season densities of Brewer's Sparrows can be highly variable between years, ranging from 50 to 350 individuals/km^2 (0.5 to 3.5 individuals/ha [0.2 to 1.4 individuals/ac]) (Weins and Rottenberry 1985 in Rottenberry et al. 1999) in southeast Oregon. In southeast Idaho, densities ranged from 116 to 192 individuals/km^2 (1.16 to 1.92/ha [0.47 to 0.78/ac]) (Oetersin and Best 1897 in Rottenberry et al. 1999); and in central Oregon, densities ranged from 111 to 277 individuals/km^2 (1.11 to 2.77/ha [0.45 to 1.12/ac]) (Rottenberry et al. 1999). Assuming an approximate density of 2.47 individuals/ha [1 individual/ac] for populations in the project study area, the habitat losses listed above could theoretically result in loss of habitat sufficient to support 554 to 774 brewer's sparrows. However, the existing habitat in the project study area is not sufficient to support such a density of birds. Moreover, because this species has been documented only as a rare summer visitant, these estimates are clearly extreme. Accordingly, the proposed action would likely have only a small effect on this species.

Additionally, the direct impacts of the Legacy Parkway project would affect less than 0.1 percent of the overall extent of these habitats in the regional study area (Table 4.13-7). The proposed action would therefore not affect the long-term viability of this species in the GSLE. It would, however, contribute to the local and regional cumulative reduction of suitable foraging habitat for this species.

Utah Division of Wildlife Resources Wildlife Species of Concern

American White Pelican

American white pelicans (*Pelecanus erythrorhynchus*) are rare summer visitants to the project study area (Table 4.13-1). All the build alternatives would result in the direct loss of small areas of potential foraging habitat (i.e., open water) for this species. Alternative A would result in 3.7 ha (9.1 ac) of habitat loss; Alternative B in 7.4 ha (18.2 ac); Alternative C in 0.6 ha (1.4 ac); and Alternative E in 3.9 ha (9.6 ac). The direct impacts of the Legacy Parkway project would be minimal on this species, affecting less than 0.1 percent of the overall extent of these habitats in the regional study area (Table 4.13-6). However, these changes would contribute to the local and regional cumulative reduction of suitable foraging habitat for this species.

Short-Eared Owl

Short-eared owls are uncommon breeders in the project study area (Table 4.13-1). In the project study area, they are likely to be found in sedge cattail, hydric meadow, mudflat/pickleweed, pasture, cropland, and salt desert scrub habitats. All the build alternatives would result in the direct loss of breeding and foraging habitats that could potentially be used by this species. Alternative A would result in 236.6 ha (584.6 ac) of habitat loss; Alternative B in 331.0 ha (817.9 ac); Alternative C in 249.4 ha (616.4 ac), and Alternative E in 232.5 ha (574.4 ac). This species exhibits considerable variation in the size of breeding territories (Holt and Leasure 1993); territories range from 20 to 121 ha/pair (49 to 299 ac/pair) in North American populations (Holt and Leasure 1993). If short-eared owls in the GSLE exhibit the same range, the proposed action would potentially result in loss of habitat sufficient to support 3 to 16 breeding pairs of short-eared owls. Sighting records in the project area suggest that the number of owls that would be affected by the proposed action would fall near the lower end of this range. The direct impacts of the Legacy Parkway project would affect less than 0.1 percent of the overall extent of these habitats in the regional study area (Table 4.13-6). The proposed action is not likely to affect the long-term viability of this species within the GSLE, but it would contribute to the local and regional cumulative reduction of suitable foraging habitat for this species.

Bobolink

Bobolinks have occasionally been observed in agricultural fields at the northern end of the project study area near the FBWMA (Table 4.13-1). All the build alternatives could result in the direct loss of some breeding and foraging habitats for this species, but site-specific habitat use information for this species is not available for the project study area. Preconstruction surveys in this area would therefore be necessary to determine whether any build alternative could disturb active bobolink nests (Federal Highway Administration et al. 2000).

Preble's Shrew

Because habitats similar to those supporting Preble's shrews (*Sorex preblei*) are present, the species may occur in hydric meadow habitat in the project study area. All the build alternatives would affect such habitat. Alternative A would result in 29.7 ha (73.3 ac) of habitat loss; Alternative B in 41.7 ha (103.0 ac); Alternative C in 39.7 ha (98.1 ac); and Alternative E in 30.6 ha (75.6 ac). Because no information is currently available on the density of this species in different habitats, it was impossible to estimate the number of shrews that could potentially be affected by the proposed action. However, the direct impacts of the Legacy Parkway project would affect less than 0.1 percent of the overall extent of habitats potentially suitable for Preble's shrew in the regional study area (Table 4.13-6).

Spotted Bat

Like many species of arid-land bats, spotted bats (*Euderma maculatum*) take their insect prey on the wing. For this reason, these aerial foragers are not tied to any specific habitats in the project study area, and direct habitat losses probably would not have any adverse effects on this species. Spotted bats could benefit from the artificial lighting that is proposed under all the build alternatives because the lighting would attract and concentrate aerial insects, potentially reducing the energetic costs of foraging for some individuals.

Townsend's Big-Eared Bat

While no studies have been conducted, it is likely that Townsend's big-eared bats (*Plecotus townsendii*) frequents suitable foraging habitat around the lake, including the project study area. Like many species of arid-land bats, Townsend's big-eared bats take their insect prey on the wing. For this reason, these aerial foragers are not tied to any specific habitats in the project study area, and direct habitat losses would probably not have any adverse effects on this species. Townsend's big-eared bats could benefit from the artificial lighting that is proposed under all the build alternatives because the lighting would attract and concentrate aerial insects, potentially reducing the energetic costs of foraging for some individuals.

Kit Fox

Great Salt Lake is located on the northeastern edge of the known distribution of kit fox (*Vulpes macrotis*) (Zevellof and Collett 1988). Kit foxes are found throughout Utah in desert and semiarid regions with flat shrub or shrub-grass communities with little ground cover. Where these foxes occur in the Great Basin, shadscale, greasewood, and sagebrush communities are common. Major prey items include desert rodents, jackrabbits, cottontail rabbits, groundnesting birds, reptiles, and insects.

Due to limited suitable habitat along the Wasatch Mountains in the vicinity of the project study area, kit foxes are considered extremely rare and have a low probability of occurring there. If they do occur in the project study area, they are most likely to frequent salt desert scrub habitats. All the build alternatives could result in the direct loss of suitable habitat that could potentially be used by this species. Alternative A would result in 52.9 ha (130.8 ac) of habitat loss; Alternative B in 32.2 ha (79.6 ac); Alternative C in 61.7 ha (152.5 ac); and Alternative E in 51.5 ha (127.2 ac). The direct impacts of the Legacy Parkway

project would affect less than 0.1 percent of the overall extent of these habitats in the regional study area (Table 4.13-6), but the Legacy Parkway project would contribute to the local and regional cumulative reduction of suitable foraging habitat for this species.

4.13.3.13 Cumulative Impacts

Historic land use changes within the GSLE have significantly reduced available wildlife habitat for migratory birds and other species, both around Great Salt Lake and within the project study area, as described in the bullet items below.

- An estimated 58 percent of historic wetland/wildlife habitat in the GSLE (159,439ha [393,980 ac] of 274,633 ha [678,630 ac]) has been lost to past activities, primarily due to agriculture and urban development.

- In the Ogden and Jordan River hydrologic units combined, where the proposed action is located, approximately 66 percent of historic wetland/wildlife habitat (57,374.13 ha [141,774 ac] of 86,664 ha [214,150 ac]) has been lost.

Reasonably foreseeable future habitat loss, including that attributable to the proposed build alternatives, would result in a marked reduction in the amount of remaining natural habitat in the project study area. The combined effects of the proposed Legacy Parkway and projected land development would reduce availability of wildlife habitat within the project study area. At higher lake elevations, the combined effects of lake level, future proposed build-out independent of the project, and the proposed Legacy Parkway would leave little habitat available for wildlife within the project study area. Table 4.12-7 illustrates the effects that changes in the level of Great Salt Lake have on the availability of wetland functions and habitat in the Legacy Nature Preserve.

Adverse direct and indirect effects on wildlife habitat resulting from the proposed action when combined with historic wildlife habitat impacts and other future development impacts not related to the proposed action would contribute to declines in the local numbers of wildlife species, including migratory birds. In addition, cumulative traffic noise from Legacy Parkway and other roads developed in conjunction with future construction projects could potentially affect the behavior and reproductive capacity of various migratory bird species within the project study area and vicinity. As noted in Section 4.1.2.1, *Current Land Use and Development Trends in the Study Area*, Davis County will continue to be converted to residential, industrial, and commercial uses at a rate of approximately 283 ha (700 ac) a year. For purposes of projecting cumulative impacts on wildlife, it is assumed that all wildlife habitat in the project study area east of the proposed Legacy Parkway alignments would be lost to development but most of the wildlife habitat west of the alignments would be retained, either in the Legacy Nature Preserve or in other public and private (such as gun club) uses. Although any proposed build alternative would contribute to cumulative effects on wildlife habitat loss, the area of wildlife habitat affected by direct habitat loss is small—approximately 0.1 percent of the total amount of wildlife habitat available throughout the regional study area. A detailed discussion of these effects by hydrologic unit is presented in Section 3.11.4, *Cumulative Effects Analysis Summary*, of the wildlife technical memorandum. Highway noise effects would affect a larger area, approximately 1.3 percent of existing wildlife habitat in the regional study area. Loss or degradation of these areas and biological functions (reproductive capacity of birds affected by noise) would add to the cumulative historic and foreseeable future habitat loss and associated impacts on wildlife in the GSLE. These impacts alone, however, would not likely affect the long-term viability of any wildlife species in the GSLE. In addition, creation and maintenance of the Legacy Nature Preserve, as proposed under Alternative E, would result in the preservation of 849 ha (2,098 ac) of important wildlife habitat in perpetuity in an area that would otherwise likely be lost to development. The reasonably

foreseeable effect of this action would be to mitigate some of the population declines that would likely occur without it.

4.13.3.14 Mitigation Measures

This section provides a description of mitigation measures to compensate for wildlife impacts that would result from implementation of the proposed action. The Final EIS originally proposed compensatory mitigation for impacts associated with Alternative D (Final EIS Preferred Alternative) in the form of a Legacy Nature Preserve (Preserve) encompassing approximately 506 ha (1,251 ac) of land. This Preserve, which was later expanded as described below, would mitigate project impacts through restoration and preservation of wildlife habitat within the proposed Preserve area. As described in the Final EIS and Section 4.12.3.4, *Mitigation Measures*, of this document, the total mitigation area of the Preserve proposed by UDOT and approved by the Corps and FHWA for Alternative D (Final EIS Preferred Alternative) was 849 ha (2,098 ac). This includes 315 ha (778 ac) of wetland/riparian habitat (i.e., sedge cattail, mudflat/pickleweed, open water, riparian, and hydric meadow habitats); 532 ha (1,315 ac) of upland habitat (i.e., croplands, pasture, and scrub habitats); and 2 ha (5 ac) of developed land. The size and configuration of the Legacy Nature Preserve would be the same under Alternative E (Supplemental EIS Preferred Alternative). The location and size of the Preserve associated with Alternatives A, B, or C would be determined through consultation with the regulatory agencies if one of those alternatives were selected for construction, as described in Section 4.12.3.4, *Mitigation Measures*, of this document.

The total amount of land designated for the Preserve mitigation (see Section 4.12, *Wetlands*) was determined in three stages. In the first stage, 506 ha (1,251 ac) were identified as suitable mitigation during the preparation of the Draft EIS. It was based on the amount of land needed to mitigate the loss of wetland function based on the analysis using the wetland functional assessment models, as well as on an evaluation of wildlife habitat needs. During the preparation of the Final EIS, an additional 126 ha (317 ac) were added at the request of USFWS to mitigate impacts on wildlife that were not captured by the wetland functional assessment models and Draft EIS analysis. In the final stage, during the preparation of the Record of Decision (ROD) by the Corps, another 217 ha (530 ac) were added to the mitigation package to address concerns expressed by EPA regarding a potential for unquantified indirect impacts on wetlands and wildlife resulting from the selected build alternative. The extra 126 ha (317 ac) and 217 ha (530 ac) were acquired specifically because they adjoin Great Salt Lake and would serve as a buffer to the lake and the FBWMA.

Wildlife Benefits of Legacy Nature Preserve

The following describes the wildlife benefits that would be derived from the Legacy Nature Preserve. Appendix E, *Analysis of the Adequacy of Wetlands and Wildlife Mitigation*, provides a detailed analysis of the effectiveness of the proposed mitigation to replace wetlands and wildlife functions that would be lost or reduced by implementation of the proposed action.

Habitat Preservation

The primary mitigation for impacts on wildlife would be to restore and protect in perpetuity 849 ha (2,098 ac) of wildlife habitats in the project study area. These lands are an integral part of the wetland and associated upland habitat complexes along the eastern shore of Great Salt Lake that provide foraging and staging habitat for millions of migratory waterfowl and shorebirds each year. These lands also provide nesting habitat for many species. These habitats have been affected by past development and are at risk from future development. Most of the land within the project study area has been degraded ecologically

by agricultural, urban and industrial development, and other land use changes. These areas face continued threats from future urban growth and development in and to the west of the study area. The Final EIS disclosed that open space in Davis County was being developed at the rate of approximately 280 ha (700 ac) per year, and at that rate, most of the study area, including land now within the Legacy Nature Preserve, would be developed by 2020. This rate of development has not changed since the Final EIS (Sommerkorn pers. comm. [a]). Preservation of these lands would offset the historic and projected future cumulative loss of wetlands in the GSLE.

Habitat Restoration and Enhancement

In addition to preservation, the mitigation plan, as approved in the ROD, states that the Preserve would be managed to enhance its wildlife values. Restoration and enhancement measures would restore some of the wetland and wildlife habitat functions lost due to past land use changes. Incompatible land uses that have degraded the wildlife habitats include extensive use of all-terrain vehicles (ATVs), especially in the northern properties; over grazing; cultivated cropping; uncontrolled access by domestic pets, including feral cats and dogs; dumping of trash; and filling of wetlands. Also, in many areas the natural hydrology had been altered by farming and water development practices. Old channels and sloughs of the Jordan River were cut off from the main stem when levees prevented the river from overflowing into its historic floodplain.

Habitat restoration and enhancement measures proposed in the mitigation plan include removing roads, reseeding upland areas, leaving berms in certain areas in the southern portion of the Preserve, plugging tile drains, removing interior fences, removing utilities, and restoring hydrology to previously destroyed wetlands. Other activities to be implemented that would enhance habitat quality in the Preserve include controlling human disturbance, such as removing grazing; developing and implementing a noxious and/or invasive plant control plan; and managing water flows. A complete discussion of wetland restoration and enhancement appears in Section 4.12, *Wetlands*. In addition, a description of how these habitat restoration and enhancement efforts directly address specific impacts on wildlife is presented in Section 3.4, *Mitigation Goals and Objectives*, of Appendix F.

UDOT is committed to restoring and enhancing wetland/riparian and upland habitats in the mitigation area to ensure that they provide high wildlife value. Management for wildlife that use the Preserve would focus on enhancing and maintaining the mitigation property wetlands and uplands to maximize their use by the diverse array of migratory species currently inhabiting the regional and project study areas.

Mitigation for Habitat Loss

As described in Section 4.13.3, *Environmental Consequences*, construction of any proposed build alternative would result in direct loss of wildlife habitat in the project right-of-way. The extent and character of these losses would be a function of the location of the alignment within the matrix of habitats in the project study area. Under Alternative E, the Legacy Nature Preserve would compensate for direct impacts of the project by preserving and restoring more than four times as much wetland habitat and more than twice as much upland habitat than would be affected by the alternative)[7]. The Legacy Nature Preserve would encompass 315 ha (778 ac) of wetland/riparian habitat and 532 ha (1,315 ac) of upland habitat, which would offset the direct loss of 52 ha (129 ac) of wetland/riparian habitat and 186 ha (458 ac) of upland habitat.

[7] As noted above, the size and configuration of the Legacy Nature Preserve associated with Alternatives A, B, and C would be determined through consultation with the state and federal regulatory agencies if one of those alternatives were selected for construction.

As described above, in the absence of these mitigation lands, most of this area could be developed in the future and would result in a regional loss of potential high-quality wildlife habitat. Therefore, placing these lands in a preserve also prevents other foreseeable future cumulative impacts from occurring and preserves a large portion of the wildlife habitats identified as critical protection areas in the Davis County Wetlands Conservation Plan (Figure 4.13-12).

Effects of Lake Level Change on Availability of Wildlife Habitats in Legacy Nature Preserve

Figures 4A and 4B in Appendix E, *Analysis of the Adequacy of Wetlands and Wildlife Mitigation*, illustrate that the Preserve is also subject to natural cyclic inundation from changes in lake level. As illustrated in those figures, the types and quantity of wildlife habitat available in the Preserve is conditional on the prevailing level of the lake. As the lake level rises, terrestrial habitat converted to open saline water is no longer available to wildlife that formerly used it (e.g., 37 percent of the Preserve would be inundated at lake levels up to 4,212 ft). Species using the mitigation area would be forced to use more limited habitats closer to the highway and would potentially be increasingly subject to highway mortality and reduced habitat quality. At higher lake levels when the lake inundates most of the Preserve, those species would be displaced to other areas outside the Preserve, either within the GSLE basin or elsewhere. As lake levels recede, habitats would change.

The dynamic inundation-regrowth nature of the wildlife habitats in the proposed Preserve does not match that of the more constant ecological conditions of the upland habitats that would be lost under the build alternatives. However, the Preserve would provide large areas of quality habitat for long periods between inundation events that would be used by many species of wildlife. During high lake level periods, regional precipitation conditions that contributed to the rise in lake level are also likely to result in the "greening" of formerly dry areas around the GSLE basin and other areas along traditional wildlife migratory corridors. These areas would provide alternate refuge and stopover areas for many migrating species that would potentially use the Preserve.

It is not known how the regional dynamics of habitat availability would affect species displaced from the Preserve by high water. However, the mitigation area has significant value in preserving key habitats for these species during low lake level periods and in preserving an important part of the natural GSLE cycle.

Mitigation for Habitat Fragmentation

As described in Section 4.13.3, *Environmental Consequences*, construction of any build alternative of the Legacy Parkway project would transect the matrix of wildlife habitats in the project study area. This would result in fragmentation of existing wetland/riparian and upland habitats into smaller patches that could reduce the local carrying capacity for some species. Other possible effects of habitat fragmentation include reduced connectivity between habitat patches; increased "edge" effects; and possible dispersal barriers for some species.

The Preserve would compensate for many of these fragmentation effects by restoring and enhancing much of the existing degraded and fragmented habitat within the proposed Preserve area. The Legacy Nature Preserve would be managed to maintain large and contiguous wildlife habitat areas with low levels of human disturbance. Most wildlife species currently found there should benefit from an increased carrying capacity resulting from habitat enhancement and reversed fragmentation restoration efforts that would create a more contiguous habitat area

Mitigation for Noise Impacts on Wildlife

Based on best available information on biological impacts of highway noise on wildlife, it is likely that noise-sensitive species adjacent to the proposed build rights-of-way would either move away from the disturbance area or remain and adapt to the extent they are able, with some reductions in local population densities and species diversity. More noise-tolerant species could replace noise-sensitive species in some areas. However, the overall impact of noise on wildlife resulting from the proposed action is not expected to jeopardize the long-term viability of any species that currently use the project study area. The Preserve would mitigate adverse biological effects of highway noise through habitat enhancement that would increase the productivity of wildlife species affected by the proposed action. By improving habitat conditions (food availability, shelter from disturbance and predation), the carrying capacity of many of these species would likely increase, thereby offsetting in part the predicted population declines of these species adjacent to the proposed highway.

As additional mitigation for unquantifiable impacts on bird populations from project noise, UDOT has committed to fund a study to determine the effects of highway noise on bird populations in the project area and comparable habitats. Because there are currently no accepted methods for assessing impacts and mitigation requirements for wildlife impacts resulting from highway noise, the lead agencies have determined that a study to develop such a methodology would be appropriate mitigation for this project. The study, which is being collaboratively designed by the federal lead agencies, UDOT, USFWS, and UDWR, will include the monitoring of bird populations and noise before, during, and after construction of the highway. The results of the monitoring will be used to develop a tool for the analysis of noise impacts on wildlife for future projects. A statement of commitment outlining the specifics of the noise study, and signed by the federal lead agencies, UDOT, and the resource agencies, is included in Appendix H, *Statement of Commitment*. The Preserve would also create a distance and noise buffer of undeveloped habitat for some habitat areas west of the proposed highway alignment, including sensitive wildlife areas such as parts of the FBWMA and wetlands west of the project that are managed by local duck clubs. The Preserve would also exclude development and its associated noise in the proposed mitigation area.

Effects of Highway Noise on Quality of Habitat in the Legacy Nature Preserve

Because the Preserve is in close proximity to the proposed action, highway noise would affect wildlife within the Preserve. Under existing conditions, as estimated by the traffic noise model (Figure 4.13-14), the Preserve area is subject to noise levels mostly below 50 dB, with smaller areas closest to I-15 experiencing noise in the 50–55 dB range (Figures 4.13-14 and 4.13-15). With implementation of the Legacy Parkway project, large areas of the Preserve would potentially be subject to higher noise levels (up to >60 dB) (Figures 4.13-14 and 4.13-16). Figure 4.13-17 shows the net area (i.e., change) of each habitat that would be affected by highway noise compared to existing conditions. This figure shows increases of areas in higher noise level contours (50–>60 dB), as well as a decrease in the extent of areas currently within the 45–50 dB contour.

This noise disturbance would affect wildlife species in the same manner as described in Section 4.13.3.10. Noise-sensitive species would either move away from the disturbance or stay and adapt to the extent they are able, with potential reductions in survival rates and/or reproductive success. These impacts could affect the proposed habitat enhancement benefits for parts of the Preserve, as described above, particularly parts of the Preserve adjacent to the highway. The proposed monitoring program would provide quantitative information on the nature of these noise impacts in the Preserve. Implementation of specific adaptive management actions identified by the initial monitoring program described above can be equally applied to mitigate the compounding effects of noise impacts within the Preserve. The wildlife technical memorandum describes these effects in greater detail.

Other Mitigation Measures to Protect Wildlife Habitat

Under all build alternatives, the following measures to minimize wetland and wildlife habitat impacts would be implemented during project construction and would be incorporated into the final project design.

- Culverts would be placed under the highway within the Corps floodplain boundary to maintain hydrologic connections between the east and west sides of the parkway during high lake levels.

- Surface water conveyance and groundwater conveyance structures would be installed wherever existing hydrologic connections or wetlands are present. The roadway design has been modified to lower the embankment height in non-floodplain areas to further minimize the minor effect of soil compaction on the subsurface water table.

- Best management practices (BMPs) would be employed to limit the amount of eroded sediment and other materials that leave the right-of-way.

- Vegetated filter strips would be constructed to remove pollutants from highway runoff.

- .Native vegetation would be used, as much as possible, for artificial landscaping.